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Saab Gripen

by Glenn Sands

The Flygvapnet (Swedish Air Force) has a long history of operating Saab's unique, indigenously designed aircraft dating back to the late thirties. Saab has delivered some 4,000 fighters exclusively for its nation's air force, and this has continued with the Saab JAS 39 Gripen – the first of the fourth-generation fighters to enter front-line service, for until the widespread introduction of the Eurofighter, Rafale and F-22 Raptor into squadron service it's the Gripen that all current fighters are measured against. The lightweight Gripen, weighing only 8.8 tonnes, looks set to eclipse the reputation heaped upon the family of Viggen variants by Flygvapnet pilots.

It was in 1980 that the Swedish government launched a competition to find a successor to the Viggen by establishing the JAS programme (Jakt Attack Spanning – fighter, attack, reconnaissance). Saab and several other Swedish defence companies joined forces as IG (Industri-Gruppen) JAS to develop a multi-role combat aircraft. At the time the oldest AJ37 Viggens had been in service ten years, but while the Viggen had been intended as a family with mission-specific variants, the newly proposed fighter was expected to undertake an entire range of missions utilising a single common airframe. Although Saab had been the sole supplier of aircraft to the Flygvapnet, this time it would be in competition with the General Dynamics (now Lockheed-Martin) F-16, McDonnell Douglas F/A-18 Hornet and the proposed Northrop 'big-wing' F-5S. At one time both the F-16 and F/A-18 were evaluated by Swedish pilots, although details of the evaluation have yet to be released in full.

By June 1981 the IG JAS team had submitted its initial Saab 2105 proposal. The design matured into that of an unstable, single-seat, single-engined, FBW (Fly-By-Wire), delta-winged aircraft, with an all-moving canard, which evolved into the Saab 2110. Despite other designs submitted, (one of which, the Saab 2107, had its intake mounted above the fuselage like the North American YF-107A, coupled with highly swept-back wings) the 2105 design was proclaimed the winner, if not for reasons of cost, then for simplicity and the effectiveness of what the delta-canard

layout could accomplish. This configuration had been admirably demonstrated by the Viggen. The General Electric F404 turbofan, already proven in the F/A-18 Hornet (but modified and up-rated) was selected as the powerplant for the new design.

The significance of the Gripen project was not lost on the Swedish aerospace industry – many felt that without the project Swedish industry would die. Despite diversifying into the civilian airliner market, Saab was heavily committed to military aircraft and could not sustain a loss.

Despite political wrangling within the Swedish government a decision between the parties was eventually reached that saw the signing of a contract worth \$1.87 billion which covered the development of five prototypes and an initial production run of only 30 aircraft. Options for an additional 110 were also undertaken. In September 1982, following a competition, the name Gripen was selected – in reference to a mythological winged creature with the torso of an eagle and the hindquarters of a lion.

The future of the Gripen depended on it being a credible replacement for the entire Viggen family. Saab was responsible for the airframe, whilst Volvo Aero shared assembly and testing of the F404 powerplants, designated RM12 by its original American manufacturer, General Electric.

After years of having to operate Saab Viggens in some roles that the aircraft was not suited to, at last Flygvapnet pilots have a fighter that rivals anything flying within NATO. One Gripen pilot commented that, "Comparing the Gripen to the F-16, well there simply is no comparison, Saab have produced a winner!"

A pair of Batch Two Gripens are seen on a practice intercept shortly after entering front-line service; during the first few months very little in the way of external stores were carried





01. Toting a pair of rocket pods under their wings a pair of JAS-39A head for the live weapons range in northern Sweden. Note the early- and late-colour radomes - grey examples have now been introduced fleet-wide



02. A major stumbling block was overcome with the adoption of AMRAAM on the Gripen. As requested by many potential customers the Gripen now had BVR capability

03. Known as BAS 90, the Swedish Air Force regularly practice operations away from airfields utilising the nation's major roads

04. An early model JAS-39A undergoes roadside maintenance prior to another practice combat air patrol. Note the missile mounts on the wing



05. An idea for a diorama perhaps, is this Gripen pictured in its roadside revetment

*All Photos ©Saab-BAE Systems
via Glenn Sands*



Ericsson was tasked with the development of the multi-mode, pulse-Doppler, X-band radar. The resulting PS-05 (PS-05A in its definitive form) has triple the processing capacity of the existing PS-46/A radar fitted to the JA-37 Viggen, but only 60 per cent of the volume. GEC-Ferranti had some input, using technology developed for its Blue Vixen radar for the Sea Harrier F/A Mk 2. Two PS-05 prototypes were built – one to be tested on a laboratory rig, the other in a converted AJ-37 Viggen.

The first Gripen was rolled out at Linköping on April 26th 1987, Saab's 50th anniversary. At the ceremony, Saab would allow only one side of the Gripen to be seen – the aircraft was unfinished and had a much simplified cockpit. Five prototypes were to be built and the first was supposed to fly in late November/early December that year. An unexpected delay, of over a year, was then imposed by problems with the FBW (Fly-By-Wire) control system's software package, which posed yet another challenge to the stated in-service date of 1992. The FBW system was by now the responsibility of GEC Astronics, which had acquired the original developer, Lear Siegler Astronautics, and development work continued in the United States.

It was not to be until December 9th 1988 that Gripen 39-1 flew for the first time, for a total of 51 minutes in the hands of Stig Holmström. However, the flight envelope was quickly expanded to allow for an altitude of 36,000ft and a speed of Mach 1.2. But flight testing was not without incident and on February 2nd 1989 a failure of the flight control system resulted in 39-1 veering off the runway and doing a cartwheel while landing at Linköping. The pilot Lars Rådeström was fortunate to only break an arm in the dramatic crash. A detailed investigation revealed that the cause was pilot-induced oscillation caused by flaws in the pitch control routine of the FBW control software. The official Saab statement read "the accident was caused by the aircraft experiencing increasing pitch oscillations (divergent dynamic instability) in the final stage of landing, the oscillations becoming uncontrollable. This was because movement of the control stick in the pitch axis exceeded the value predicted when designing the flight control system, whereby the safety margins were exceeded at critical frequency". Basically the computers failed to control the aircraft's pitch at low speed, either because they overcompensated for air data sensor input, or failed to keep up with the amount of information being input and became over-saturated.

Following the crash a major software test programme was



launched in the United States by Calspan, with a modified Lockheed NT-33A Shooting Star, the aircraft being flown by both Swedish and American pilots. Seventy-eight flights were performed with over 350 landings made. The exact conditions which led to the crash were recreated in an effort to investigate FCS (Flight Control System) performance. To fully replicate the cause of the accident, the NT-33A was fitted with a Gripen style control column in its front cockpit, although the aircraft was always flown by two pilots as a safety measure and to reduce the test workload. This flight testing, although successful in locating the problems with the FBW system, was to add a further 15 months' delay before the second prototype was ready to fly on May 4th 1990. By this stage the Gripen programme was some three years behind. Arne Lindholm who first flew 39-2 commented that the aircraft felt stable and that the FCS was much smoother than in the first aircraft.

Like the original prototype the second Gripen, 39-2, carried a minimum of avionics but was fitted throughout with strain gauges. By September 1990, fourteen flights had been completed, but compared to the predicted year's total of over 100, there was still along way to go. Reluctantly service deliveries were set back one year to 1993.

Despite the setbacks and a detailed investigation by the government, Saab continued with the Gripen's development and studies were launched into the development of a two-seat JAS-39B aircraft, which had originally begun in 1989. By now the single-seat programme was developing fast and on December 20th 1990 the fourth aircraft, 39-4 became the third Gripen to fly. This particular aircraft was the first to be equipped with production avionics, but had no radar. Gripen No. 3, 39-3 made its first flight on March 25th, 1991 with full standard avionics, display and radar, but had been delayed prior to its maiden flight due to engine problems. It was followed into the air by 39-5 on October 23rd 1991. One JAS-39A within Batch One was not completed as planned, instead the prototype two-seater was inserted into Batch One production. The JAS-39B was not actually the last Batch One aircraft to be built, the first two-seater taking over the last serial in the Block One batch. The first JAS-39B (39-800) was separate from the 28 production two-seaters that would be ordered later in Batches Two and Three.

With an adequate number of prototype Gripens now in the air, the aircraft were adapted to undertake specific flight tests within the programme: 39-2 was fitted with a modified FCS for expanding the flight envelope, while 39-3 became the weapons test bed.

Flight testing soon revealed problems with the Volvo-Flygmotor RM12 powerplant, a licence-built General Electric F404. The engine suffered slow thrust build-up during manoeuvring. The afterburner lining also proved to be lacking in durability, although the latter was soon rectified by drilling holes in the casing to allow hot gases to escape. Although a number of minor technical difficulties continued to plague the flight testing the Gripen's performance had exceeded expectations.

Eight early-model Gripen are lined up for the camera shortly after entering service; even at this early stage, subtle changes between the individual aircraft can be seen

Over a typical Swedish landscape a lightly armed Gripen illustrates its current AAMs arsenal. Export customers for the Gripen are able to choose Israeli, Russian or South African AAMs for their aircraft



06. An early test flight for one of the first JAS-39Bs built. The two-seater retains the clean lines of its fighter cousin



07. The past and future of the Flygvapnet are seen together. Unlike the Draken, Dayglo numbers were worn only for a short time by the Gripen entering service



08. A front-line JAS-39B armed with Maverick AGM. After a major rethink within the Swedish military we now see two-seat Gripen performing the SEAD and Fast-FAC roles

In October 1991, Saab released its costing for the JAS-39B operational trainer and the follow-on Batch Two order for 110 single-seat aircraft. Within the month a report was released by the FMV (Försvarets Materielverk, Sweden's Defence Material Agency) on the JAS-39. Much hinged on the FMV's comments and although the Gripen received a favourable lower-than-calculated drag, so eliminating many problems associated with the RM12, and the exceptional performance of the FCS and cockpit displays, problems were encountered with the APU (auxiliary power unit), fuel system and the environmental control system. The APU was rectified by replacement with an example from Lucas Aerospace, and this would later become standard on all production aircraft. By early 1992 the flight test programme had accumulated 300 flights and the FMV believed that the JAS-39 would be able to meet all its technical requirements.

On June 3rd 1992, the order for Batch Two was signed for the Flygvapnet's ninety-six Batch Two JAS-39As and fourteen JAS-39Bs (excluding one prototype) plus spares. Production was scheduled to begin in 1996 and to continue through to 2002. A crucial part of the training programme was the two-seat JAS-39B, which finally gained approval. The two-seater was primarily to serve in the operational conversion role and tactical training, and

was expected to have a performance similar to that of the JAS-39A, although it would be less manoeuvrable. Between the two variants there is a 40 per cent commonality, with the trainer being only some 25.8in longer at its forward fuselage; an offset of this resulted in the removal of the gun and a reduction in fuel capacity. The rear cockpit is identical to the front, apart from the deletion of the HUD (Head-Up Display), but the associated imagery can be viewed on the head-down displays.

By this stage of the JAS-39A Gripen's test programme 566 flights had been accomplished including extensive weapons trials in the north of the country. The first production Gripen was now undergoing ground running tests prior to delivery, while 39-102 had left final assembly. The four Gripen prototypes were later joined by 39-101 on March 4th 1993, which undertook a maiden 44-minute flight, prior to joining the test fleet. Equipped with telemetry systems, 39-101 filled the gap left vacant in the programme with the loss of the first prototype in 1989.

The first Batch Two aircraft (39131) flew on August 20th 1996 and the first two aircraft were handed over to the FMV on December 19th 1996. The JAS-39B experienced none of the problems encountered with aircraft in Batch One and flew exactly on the day predicted at the beginning of its development.



Following experiences with Batch One Gripens a number of changes were made to the second batch. These saw the replacement of the French-built TGA15-090 APU with an improved variant, as the earlier model simply didn't live up to its stated fatigue life. By far the most significant change was the introduction of a new FCS, with Lockheed-Martin replacing the Lear unit. The new system utilised a different and more advanced architecture and allowed flight test team engineers to explore a whole new range of possibilities – the offset of this was that the new system, which was critical to improving Gripen's performance, meant that all of the associated systems had to be rechecked and requalified to ensure compatibility, so costing more money but more important perhaps – bringing further delay to the programme!

By 21st April 1993, the 1,000th test flight had taken place. Gripen 39-102 became the first JAS-39A to be handed over to the Flygvapnet at Linköping on June 8th 1993, being delivered to F7 at Sätenäs later the same day. By the end of June 1st, 1,122 tests flights had been performed, in addition aircraft 39-103 to 39-108 were in final assembly with Gripens 39-109 to 39-122 on the production line. However, the Gripen programme was to receive another blow in the loss of 39-102 during an air display over Stockholm; fortunately the pilot, Lars Rådestrom ejected when the Gripen stalled at low altitude. Saab attributed the accident to "the flight control's system's high amplification of stick commands in combination with large, rapid stick movements by the pilot. This led to the stability margin being exceeded, and the aircraft entered a stall". Flying was suspended until December 29th 1993, until the fitting of further updated flight control software.

By mid-1994 the remaining test Gripen in service had completed over 1,400 flights completing some 65 per cent of their test programme. The all important weapons test included live firings of Rb 74 (AIM-9L Sidewinder) at up to 6g, Rb 75 (AGM-65 Maverick) firings at 3g and successful separations from DWS 39, Rbs 15F, cannon pods and external tanks. Arming the Gripen became one of the most involved issues of recent times, and perhaps was to foretell the current on-going debate with the Eurofighter. Basic armament for all roles includes an integral 27-mm Mauser BK27 cannon recessed under the port centre fuselage and two wingtip mounted Rb 74 or other IR-homing AAMs, supplemented by four underwing-mounted ventral pylons for external stores. The electrically-driven BK27 had originally been developed for the Panavia Tornado and is capable of firing 1,000 or 1,700 rounds-per-minute.

The Batch Three deal was signed by the FMV on June 26th 1997. The contract confirmed an additional sixty-four aircraft (fifty single-seat and fourteen two-seaters). However this most recent batch was subject to repeated threats from budget cuts, and so numbers involved were not to be as high as the air force

would have liked, but not as low as feared. Deliveries are scheduled for 2003 to 2007. At the signing of the Batch Three deal, forty aircraft had been delivered to the Swedish Air Force, and the deal secured the production of the Gripen for the next ten years. The sixty-four aircraft were expected to equip four squadrons.

Batch Three aircraft are deemed by many to be the definitive Gripen variant and already have a developmental path laid out for them to counter the perceived '2010 air threat'. This programme is expected to centre around associated weapons and sensor improvements, but externally the aircraft is expected to change very little. At one time it was rumoured that in a few years Gripens could be fitted with TVC (Thrust-Vectored Control), coupled with the introduction of a new powerplant, however, this development was later cancelled due to lack of funding. Saab were reluctant to go with the TVC option stating that to gain the full benefit of the technology an aircraft needs to be designed from the outset with this in mind. One of the key components of Batch Three aircraft will be the addition of inflight-refuelling as standard, a full colour cockpit with larger displays and improved computers. The introduction of such state-of-the-art equipment will see a revised designation to that of JAS-39C and JAS-39D for single- and two-seat aircraft respectively, although as yet these designations still have to be approved.

When the Gripen entered service it initially replaced the AJ-37 'attack' Viggens. The role saw the Gripen being the first aircraft to carry the MBB DWS 39 stand-off sub-munitions dispenser, although this variant is unpowered relying on GPS (Global Positioning System) and four tail-mounted control fins to find its pre-programmed target. A typical load for the weapon could include twenty-four runway denial bomblets, ninety-six cluster munitions, 120 anti-tank mines, 504 SB44 bomblets or 1,848 M42 GP bomblets. Possible 'smart' sub-munitions for the DWS 39 are under development. For 'hard targets' the Gripen can be armed with the AGM-65A/B Maverick, known as the Rb 75 in Flygvapnet service, which is able to hit a tank from over 6 km!

By far the most important role for the Gripen however, given the geographical location of Sweden to its neighbours and 'enemies', is that of anti-shipping. For this the aircraft is armed with the Saab Rbs 15F (Rbs - meaning - Robot missile) medium-range ASM. The 15F was originally used by the Swedish Navy for its fast patrol boats, but has been suitably modified to allow for air launching. It became operational in 1989. Since then the missile has been modified to be more ECCM (Electronic Counter-Countermeasures) resistant and been fitted with an improved seeker head and central computer, so increasing the weapon's range.

Apart from ground-attack and maritime defence, if the Gripen was to survive among the fourth-generation fighters, it had to

A JAS-39A with a maritime attack loadout comprising two Mavericks and two Rb 15F anti-ship missiles. Two Sidewinders are maintained for self-defence



09. In Swedish service the AIM-120B AMRAAM is known as the Rb 99 (Rb, Robot-missile)

10. A JAS-39B carrying a demonstration load of six Rb 74 Sidewinders. The black staining is from the aircraft's APU exhaust.



11. Viewed from above the camouflage pattern can be clearly seen. Low-vis roundels and the removal of the typical Dayglo numbers was first introduced within the Gripen squadrons

12. The Austrian Air Force has had a long association with the Swedish Air Force in both joint exercises as here, and operating similar aircraft. Here Draken are pictured in formation with a trio of Gripen



13. Gripen from F7 Wing are seen in formation prior to a flypast during an airshow. For the time being the Gripen is the only fourth-generation fighter to be in operational service



have the capability to fight BVR (Beyond Visual Range). While the 'day of the dogfight is alive and well' the capability to destroy an enemy at great distance has become the 'Holy Grail' amongst fighter aircraft designers, and Saab were to be no exception. For the BVR option the Gripen carries the Hughes AIM-120 AMRAAM (Advanced Medium Range Air-to-Air Missile). The FMV acquired 100 AMRAAMs in August 1994, with deliveries commencing in January 1998. From the outset it was intended that the Gripen was to be fully compatible with the missile and contacts with the US parties associated with the Ericsson PS-05/A radar were established to ensure a fully working system could be operational with active-radar AAMs. The first test firing of the missile and system was made in 1998, with the first live launch following a short time later, this particular test involving high-g manoeuvres during launching. It is worth noting that the Swedish test firing of the AMRAAM (Advanced Medium Range Air-to-Air Missile) were the first to be conducted outside the US; many nations have had to travel to the missile ranges on the West and South Coasts of the US to gain the necessary data. Now fully operational within Gripen squadrons the AIM-120B AMRAAM has been given the Swedish designation Rb 99.

Despite the advancement of the lethality of missiles and stand-off weapons Saab have been keenly aware of the need to manage the air battle in the cockpit, in particular because of the Gripen being a single-seat aircraft. The need to get up-to-date information to the pilot, either prior to a mission or during the attack, has led to the Gripen being the leader in its field with the operational use of the digital datalink.

Swedish technology has seen the TIDLS (Tactical Information Datalink System) used operationally for a number of years amongst the JA-37 Viggen units, and a similar system was installed on the JAS-39A and JAS-39B. At its most basic level the Gripen is able to transmit radar, sensor and aircraft status to anywhere, be it another orbiting aircraft such as an S-101B Argus AEW platform or back to its airfield, or simply to another Gripen flying alongside. To send the data all the pilot has to do is simply select the designated channel and transmit. An airborne Gripen can data-link real-time combat information straight to the cockpit of another aircraft being rearmed and refuelled prior to another strike. Thus a following Gripen pilot will have been fully briefed on the current tactical situation without ever having to leave the cockpit. A second attack would now see the pilots being able to strike any remaining targets without wasting any time debriefing on the ground.

Recently Saab have integrated a further variety of weapons into the Gripen's arsenal with priority being given to the use of PGMs (Precision Guided Munitions) and LGB (Laser Guided Bombs). The use of such weapons will see the installation of the Rafael Litening pod which will be fitted to the starboard-side No.4 shoulder station. At present the pod is capable of providing the Gripen with navigation at low-altitude in all weathers and laser-spot tracking for use with PGMs, however, this option at present is only offered to export customers interested in acquiring the Gripen.

While improvement programmes for the Gripen continue to be developed the export sales of the aircraft look set to play a critical role in the aircraft's development. In contrast to Russian and US manufacturers, which often fielded 'export standard' aircraft, which more often than not were 'watered-down' relatives to the real thing, in the Gripen's case the export aircraft, at this moment in time, are more capable than those serving with the Flygvapnet. But coupled with the desire of foreign nations to acquire the Gripen is the requirement that they have gained approval to receive the US-built AIM-120 AMRAAM. With the overriding factor being the air-to-air role for many nations seeking a new fighter, the list of only seventeen nations



authorised to receive the missile seems potentially very small and was predicted to hinder the Gripen's export success, but this was not to be the case. Aware of the potential of the Gripen within the global fighter market, and having provided technical support throughout the aircraft's development, BAe acquired a 35 per cent share of Saab's military aircraft division, the former having since become BAe Systems. The implication of this is that within the export market the fighter is marketed as the Saab-BAe Gripen.

South Africa was an unexpected first customer for the aircraft in November 1998. The twenty-eight Gripens are expected to replace the Cheetah C and Cheetah D. Initially deliveries will commence with nine two-seat models to be delivered between 2007 and 2009, with a second batch of 19 single-seat models to arrive between 2009 and 2012. One potential benefit of this deal is that all of the South African Air Force (SAAF) Gripen will be fitted with a completely new weapons fit. Denel Kentron, South Africa's primary arms producer will supply their own fifth-generation off-boresight dogfight missile the V-3E A-Darter (Agile Darter). By far the most significant change will be in the installation of the indigenous BVR missile, the R-Darter, so allowing the Gripen BVR capability without the restrictions imposed by the US.

Another alternative for Gripen armament is that of utilising Israeli missiles. The reputation gained by the combat-proven Python series of AAMs is without question. The British option with the Meteor long-range BVR, although not included in present plans, is still viable. Saab have also expressed the capability to equip the Gripen with Russian missiles should a customer require it.

Whilst the Western nations have not sought to acquire the Gripen, a result of developing either their own fourth-generation fighter in partnerships or have simply upgrade their own current stock of fighters, the Gripen continues to gain orders from smaller European nations. Recently the Czech Republic has announced it will order twenty-four Gripen to replace its MiG-21s. The first Czech squadron is expected to be operational with the type in late 2005. Quickly following this announcement was Hungary's decision to select the Gripen, in the process being the first NATO country to do so, with a reduced order for just fourteen aircraft. Orders from further NATO countries are yet to be forthcoming.

Saab continues to actively promote the Gripen to Austria, Brazil, Chile, the Philippines and Poland and immense interest has been expressed by South American nations. By far the largest potential customer is Brazil which is looking to replace its upgraded F-5E and Mirage III force; such a requirement could

Saab has long held an interest in South America with a host of potential customers for the Gripen. Chilean air force pilots undertook a number of test flights in the fighter and look set to order the aircraft in the near future, although how many is subject to debate. Here a pair of Gripen fly in formation with a CASA 101

see an order for up to 150 aircraft, but a formal competition to seek a replacement is a few years away. Chile's Fighter 2000 competition continues to be delayed until appropriate funding can be found.

While Saab has continued to seek potential customers for the Gripen over the last few years, the Flygvapnet have quietly brought their 'own aircraft' into front-line service.

The first operational Gripen unit was F7 Skaraborgs Flygflottilj (F7 Wing) at Sätenäs, in south-western Sweden. F7 has established a tradition as a 'lead unit'. F7 has three component squadrons, which like all Swedish squadrons are designated by colour: Red 1st Squadron, Blue 2nd Squadron, Yellow 3rd Squadron. The first Gripen squadron was Gustaf Blå (2nd Squadron), which was declared fully operational on November 1st 1997, and it was soon followed by Gustaf Röd (3rd Squadron) on December 30th 1998.

It is worth noting that the markings and camouflage schemes applied to the Gripen force have changed several times over the years. Initially an overall matt grey finish, with high visibility national markings, was applied to the first few production aircraft. Most Batch One deliveries carried black unit markings on the nose and Dayglo codes on the fins. On the Gripen the code always reflects the last two digits of the aircraft's serial. Batch Two aircraft introduced low-vis grey markings on an overall grey finish. The black radome was removed as a result of radar propagation problems.

On September 30th 1999 the first pair of Gripens arrived at F10 Skåne Wing, Ängelholm, to become the third of Sweden's planned Gripen squadrons. But despite the capabilities of the new fighter and the pressing need to replace Viggens in service, a Swedish Defence Review at the time, which was as a response to the changing threats within and outside Europe, saw to it that the air force was to get only eight Gripen squadrons, distributed

over four wings at Ängelholm. Any other funds remaining would be diverted to Sweden's clandestine maritime special forces units. It is an ironic twist of fate that Ängelholm had only just completed an expensive modernisation programme in preparation for the Gripen's arrival, now the base will simply be closed down.

Other changes to the defence policy will see the planned F16 Uppland Wing, at Uppsala, become the third Gripen wing. As of late 1999, the early conversion phase had already begun. Now, F21 Northern Wing, at Luleå in northern Sweden, has become the next unit to transition to the Gripen. Conversion for the wing's technicians and pilots started later that year. It is planned that the wing's first operational fighter squadron will be fully manned by late 2002. The reconnaissance squadron at F21 is scheduled to fly its AJ/SF/AJSH Viggens until the end of 2003. The first of the two squadrons of F4 Jämtland Wing based at Östersund, began conversion in 2002. This year also saw the relocation of F10's Gripens to F17 Wing at Ronneby, which now means all four Flygvapnet wings should have partially re-equipped by 2004. It is planned that each of the eight squadrons will have twenty-five Gripens, but F7 Wing will maintain two oversized squadrons with aircraft and personnel equivalent to three of today's squadrons, which typically operate about sixteen aircraft. It is intended, unlike in the past, that no Gripens will be kept in reserve or storage – all will be kept flying on a rotational basis. This new policy is planned to be fully operational by 2003. To date the Flygvapnet has received 104 single-seat JAS-39A Gripens and twelve two-seat JAS-39Bs. Such has been the success of the aircraft in operational service that in recent months a drastic rethink has been implemented by the Flygvapnet. The long-assumed upgrade and improvement programme for the Gripen by way of each successive batch delivered being equipped with ever more sophisticated avionics and EW (Electronic Warfare) suite, those of Batch Three, often termed the definitive Gripen, to date have recently received an additional twenty aircraft increase by the Flygvapnet, although these are not expected to reach operational squadrons until 2003. Unable to wait, Sweden has implemented the Batch Three modifications to those Gripens of Batch Two which are still on the production line, approximately twenty airframes.

However, by far the biggest change has been to the two-seaters that are included within Batch Three; these aircraft are no longer expected to serve as trainers and will now be re-roled. Having kept an ever watchful eye on others' combat experiences has shown the Swedish Government that there is a need for a two-seat front-line fighter and the JAS-39D, looks set to fulfil this role. It is intended that the JAS-39D will be optimised as a dedicated mission specialist. Presently Sweden is exploring the aircraft's role as a strike package leader, a mini-AWACS and specialist PGM (Precision Guided Munitions) delivery and designation platform. Although not widely mentioned many believe that undoubtedly the SEAD (Suppression of Enemy Air Defences) role will also be included in the two-seat Gripen's capabilities.

To date the Gripen has quietly become the first fourth-generation aircraft to enter operational service. While yet to reach its full potential in terms of war fighting ability, future Gripens have the option to select the very best missile technology and electronic warfare suites from both sides of the Atlantic, and future orders for the type will undoubtedly be forthcoming. Although the Gripen didn't arrive on the fighter world's market with the hype that surrounded the F-22 Raptor's and Eurofighter's first flights, none of these are in front-line service. Saab's Gripen arrived quietly and exceeded all its planned expectations and entered service. How does the saying go? 'It's the quiet ones you have to watch!' **MAM**

During the 1997 Paris Air Salon, Saab staged this unique formation with a P-51D Mustang from the Breitling Fighter Collection





1-6. Overall views of the subjects of this Photo Album. These Polikarpov I-16 Type 24 'Rata' were restored in Russia and are owned by the Alpine Fighter Collection in Wanaka, New Zealand

Polikarpov I-16 Type 24

by David Frowen





7. This shot of 'White 26' clearly shows the 'chubby' shape of the I-16 as well as the cockpit access door, windscreen and engine cowling shape

8. This view from the rear gives a good idea of how small the I-16 really is

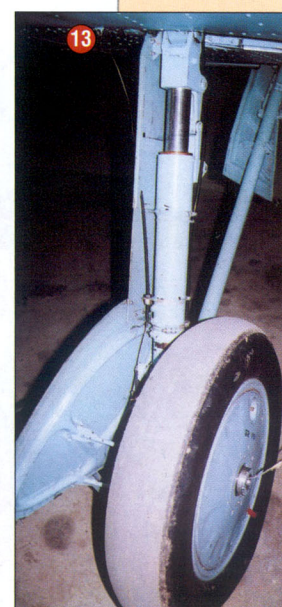
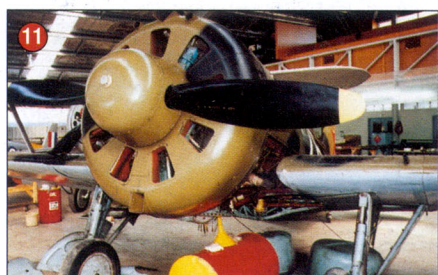
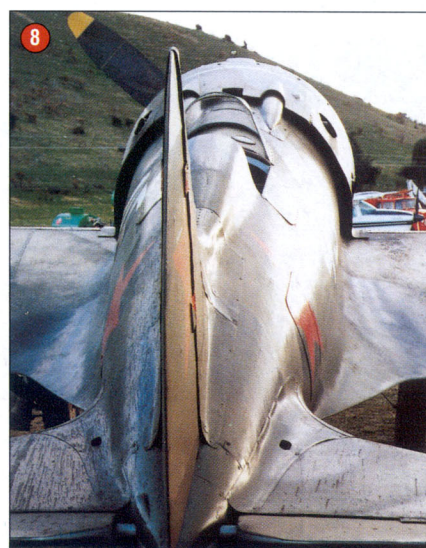
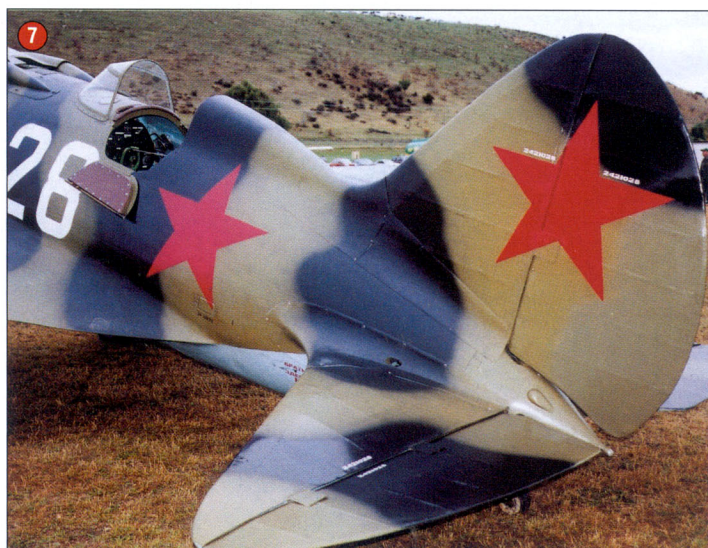
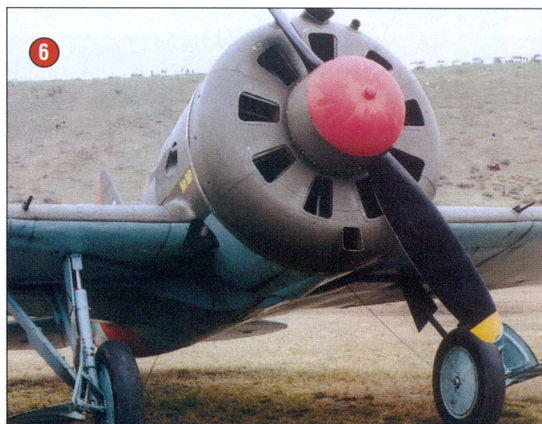
9. Close-up of the tail showing the metal skinning of the fuselage, vertical fin and tailplane, plus the fabric-covered control surfaces

10. This shot of the starboard wing clearly shows the metal inner, and fabric-covered outer sections

11. This close-up clearly shows the shutters in the engine cowling. Note the wheel wells on the floor, with the retraction wire still running through them

12. This overall shot of the undercarriage area gives you some idea of how the exhausts stain it

13. Close-up of the starboard undercarriage leg. The wire running from the wheel centre is for retraction as the type has no pneumatic or hydraulic retraction system



14. This view up under the port side clearly shows the tubular structure of the type's fuselage

15. A look into one of the cockpits. Note the holes in the coaming above the instrument panel to help light it, and the hand holes in the forward edge of the coaming for pilot entry

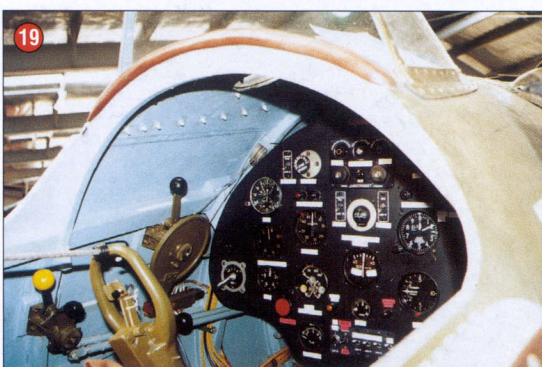
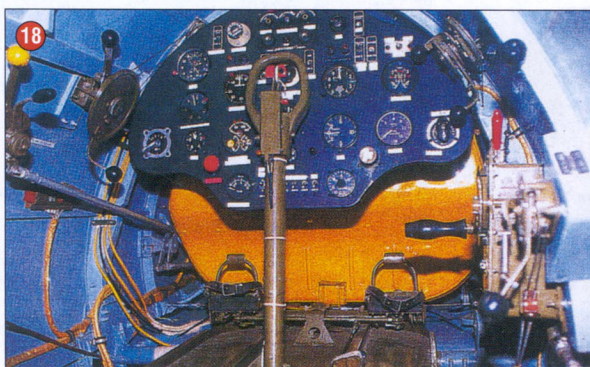
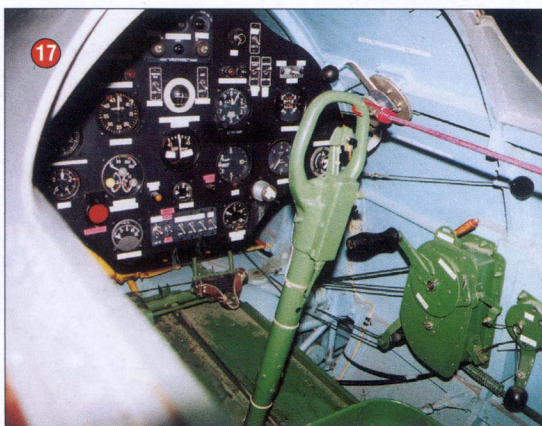
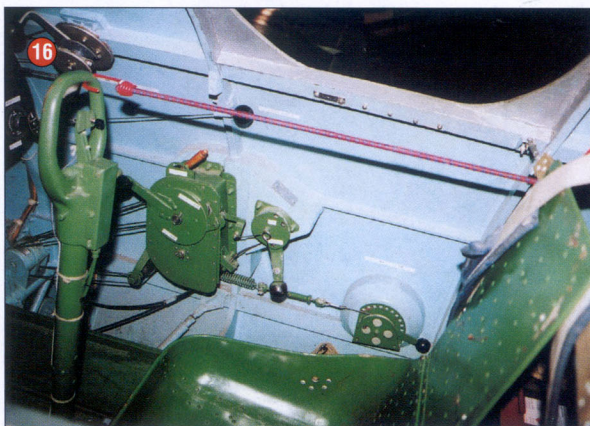
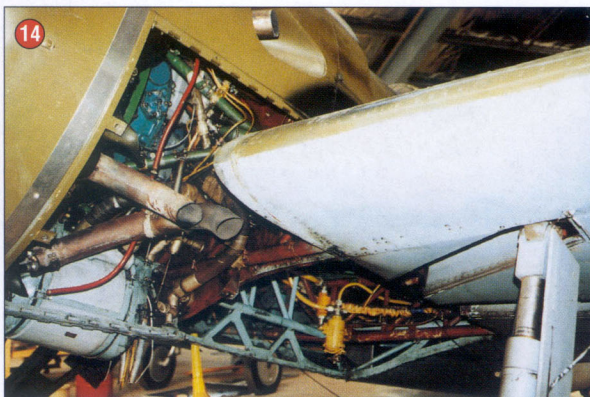
16. Starboard cockpit side. Prominent in this area are the seat and control column, while on the sidewall you can see the undercarriage retraction crank

17. A look at the control column and instrument panel

18. Overall shot of the cockpit interior (©Alpine Fighter Collection via D. Frowen)

19. Port cockpit sidewall. Note the throttle quadrant and the dark green colour used for the controls in this machine

20-22. Overall shots of the Alpine Fighter Collection's I-16s in action





Z2015 (F. 5589)
Used for the
November 1944
press release series.
Was delivered to
Wroughton, 24th
April 1944. Flown by
Flt Lt F. H. Dixon

The Firefly Mk I in FAA Service

by Ian Huntley

The Firefly as Spec.N.5/40 (a combination of two earlier specifications) emerged as an all-metal, two-seat, naval fighter, which was the culmination of a whole series of similar fighter and light bomber monoplane designs which dated back to the pre-Battle days of 1932, when the company produced at least a dozen design studies for every Project Specification that came their way in the hope of possible adoption by either the RAF, or FAA.

Whilst many of the former designs had been the work of design teams under Marcel J. O. Lobelle, the Firefly resulted from a team led by H. E. Chaplin. Chaplin had the benefit of Fairey experience gained in metal monocoque construction over the fore-mentioned period, and thus when the Firefly prototype Z1826 (F.5470) emerged from the Flight Shed at the Great West Aerodrome, on a misty December day in 1941, it represented an immensely strong airframe, which would pack a heavy armament of four 20mm Hispano cannon, and at that time an undisclosed and varied load of externally carried bombs, and other weapons.

Construction had been unique as the fuselage was built in two halves split along the vertical centreline, and after all equipment had been installed, it was internally butt-strapped together, and then bolted on to the wing centre-section, complete with main undercarriage, and after the tail components had been added, the power-plant which was supplied as a complete 'power egg', was merely bolted straight on to the firewall bulkhead. The machine could then leave the main assembly line and have the outer wings attached, and with final fitments made, it was virtually complete other than painting.

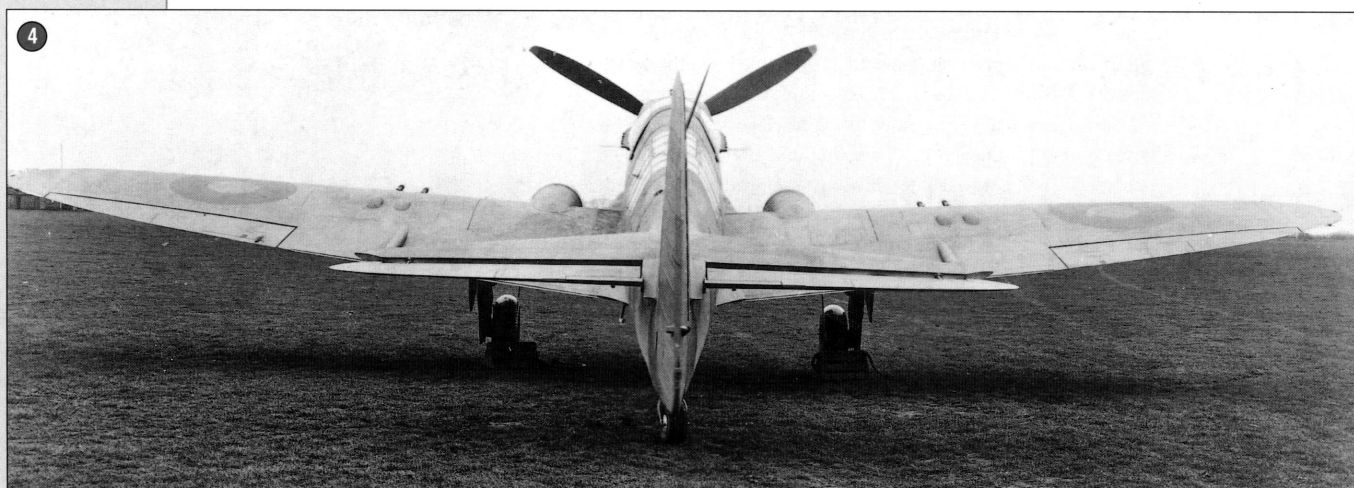
Powered initially by a 1,730hp Rolls-Royce Griffon IIB, twelve-cylinder, vee, liquid-cooled engine, in its unpainted form and with dummy cannon and no military equipment or passenger on board, Z1826 was, after its initial test flight with Flt



1. Prototype Firefly Z1826 (F5470) at the Great West Aerodrome, November 1941, in unpainted form.

2. Firefly Z1875 was built as a Mk I early in 1943. It was however later converted to serve as an NF Mk II second prototype. Photographed just before being dispatched to RAF Defford on the 28th February 1944, it had seen sufficient trials activity to appear quite 'tatty'. Note how the wing roundels are faded in comparison with the fuselage and fin markings. Matt Extra Dark Sea Grey, Dark Slate Grey and Sky finish with dull identification colours

3 & 4. Firefly NF Mk II, Z1875 (F5500) served as second NF prototype. Delivered to Wroughton, 22nd February 1944.



Lt Chris Staniland, on 22nd December 1941, capable of some 325mph at 15,000ft. This was an encouraging speed for such a large machine, but it was feared when up to full specification and crew, it would lose some 8 to 10mph.

Prototype Colours

For the roll-out from the GWA Flight Shed, and its first flight, most of the airframe was left in bright unpainted Alclad skinning or thicker anodised Duralumin plating, with the exception of the Griffon power-egg cowlings, main fuel tank cover, radio bay cover, mast, all trim tabs, and the fin tip with anti-spin parachute guard attached, all being in Grey Green primer. The airframe interior was similarly painted, including the cockpits, wheel wells and inside faces of the undercarriage leg fairings.

The fabric-covered ailerons, elevators and rudder were in Dull Red (shrink) primer. The spinner was Matt Night, as was the three-bladed Rotol propeller, with four-inch yellow tips. The only identification was 'Z1826' stencilled in four-inch Night characters on the rear fuselage.

Shortly after the first flight the whole of the airframe was over-painted in Dark Grey synthetic primer and national markings of the 1940-41 type were added. An interesting note on the drawing showed that the rear fuselage demarcation between upper and lower colourings had been almost a straight line from the wing root fairing up to the leading edge of the tail-plane, thereafter running aft horizontally across the rudder.

As with most prototype airframes the flying control surfaces often need adaption, at least until test programme pilots felt happy that they had reasonably balanced and responsive controls, and Staniland (and A&AEE pilots) found the Firefly no exception, and probably until most of these problems had been sorted, Z1826 remained in the Dark Grey primer/yellow finish.

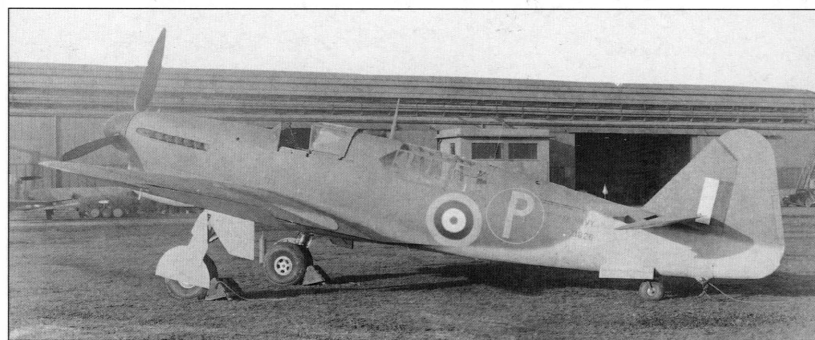
Camouflage

The design of the initial pattern was roughly based upon that of the Fulmar, and followed the instructions laid down in AMO A 513 (10.7.41), and the amendments as given in AMO. A.687 (28.8.41), where the former gave the scheme for prototype and experimental aircraft as being Dark Green and Dark Earth, with yellow undersurfaces. These details were shown on Fairey GA. Camouflage Drg.AJ.Sht 46 Iss. 1 (10-10-41). Following that, a rather approximate 'Sea Scheme' was shown on GA Camouflage Drg.AJ.Sht 28, Iss. 5 (9-12-41), but appears not to have been put to use. Into 1942 and with most of the flying control problems overcome, the camouflage scheme was applied to Z1826, as seen in photographs taken when at the RAE Farnborough, in March.

However because of the addition immediately aft of the roundel, of the new prototype marking consisting of a yellow 'P' surrounded by a narrow yellow ring, which would have placed this letter mostly upon a yellow surface, the camouflage colours were brought down in a more sharply curved style to form a dark background behind the device. 'ROYAL NAVY' in four-inch letters was added four inches above the fuselage registration.

The second prototype Z1827 (F.5471) flew on 4th June, 1942,

Prototype Firefly Z1826 (F.5470) at the Great West Aerodrome after painting, and ready for RAE Farnborough, March 1942.



Z2035 (F. 5609) very early Firefly Mk I delivered to Wroughton, 8th May 1944. Flown by Flt Lt F. H. Dixon

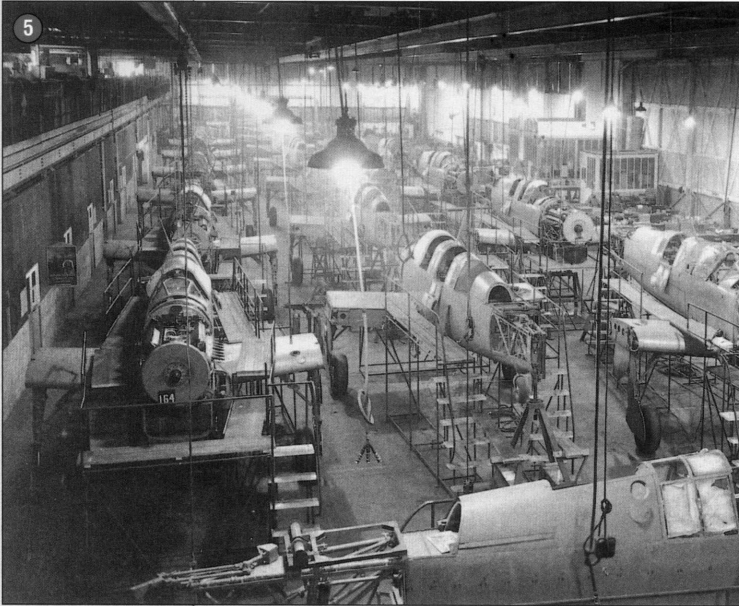
and as far as is known was in the Dark Grey Primer/Yellow scheme but with the new style, post-May 1942, national markings, plus the yellow prototype 'P', but with 'ROYAL NAVY', and the fuselage registration stencilled in Sky Grey. {Unfortunately this machine was to crash on 26th June, killing Staniland. The subsequent report cited failure of the elevators, but there were rumours that either the radio bay cover, or the pilot's cockpit hooding coming adrift had been the primary cause of the damage to the elevators. Certainly both structures were exceedingly flimsy, and were both redesigned along with the elevators and tailplane}.

Camouflage to the original pattern and colours continued to be used on the remaining prototypes and experimental airframes, though those airframes carrying out test duties had the yellow undersurfaces but did not necessarily carry the 'P' marking.

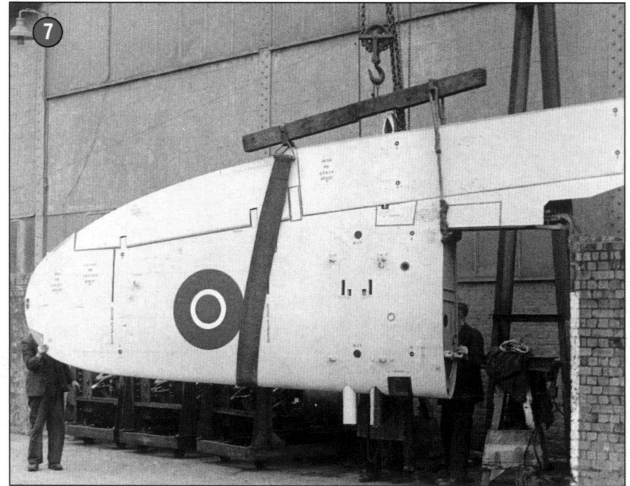
The Production Scheme

Meantime the original camouflage pattern of September 1941 came under Ministry scrutiny, and the Hayes Design Office were asked to produce a developed pattern to be applied subsequent to the prototype airframes and for the main production contracts. The new scheme, as in Air Diagrams, AD.1159, and 1160, was in plan a little more convoluted in places and more dissimilar wing-for-wing in design and employed both the Dark Green/Dark Earth and Yellow when required for experimental working, and the Temperate Sea Scheme of Extra Dark Sea Grey and Dark Slate Grey for the uppersurfaces and Sky for the undersurfaces of operational production machines. These details appeared first on GA Camouflage Drg.AJ Sht. 90 Iss. 1 (10-7-42).

Initially at any rate, the same modified rear fuselage curved style of paint demarcation as was employed on the prototypes was adopted, but a subsequent and later modification was introduced which dropped the upper surface colours down in a similar curve immediately aft of the tailplane which brought camouflage to the extreme end of the fuselage and across the rudder lower surfaces. This design was accepted and a subsequent issue of the paint scheme drawing made only very slight and subtle changes to the demarcations in order to ease Dope Shop operations. DTD 83A C was used on fabric areas, whilst on early machines DTD 308 C and DTD 314 S were used to clear existing paint stocks.



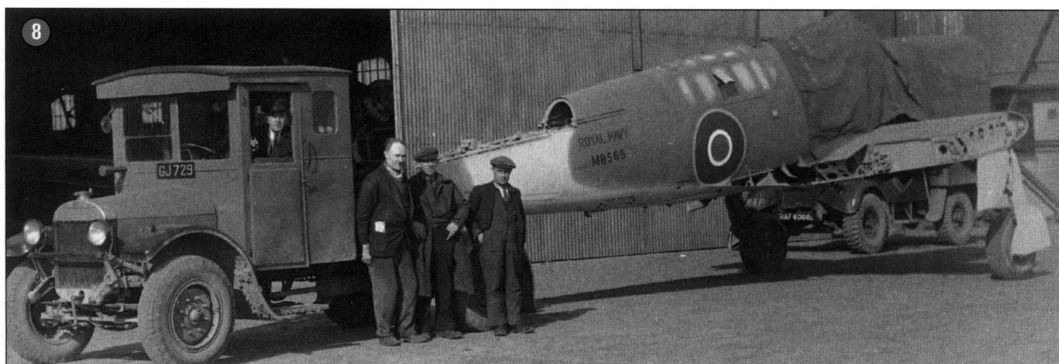
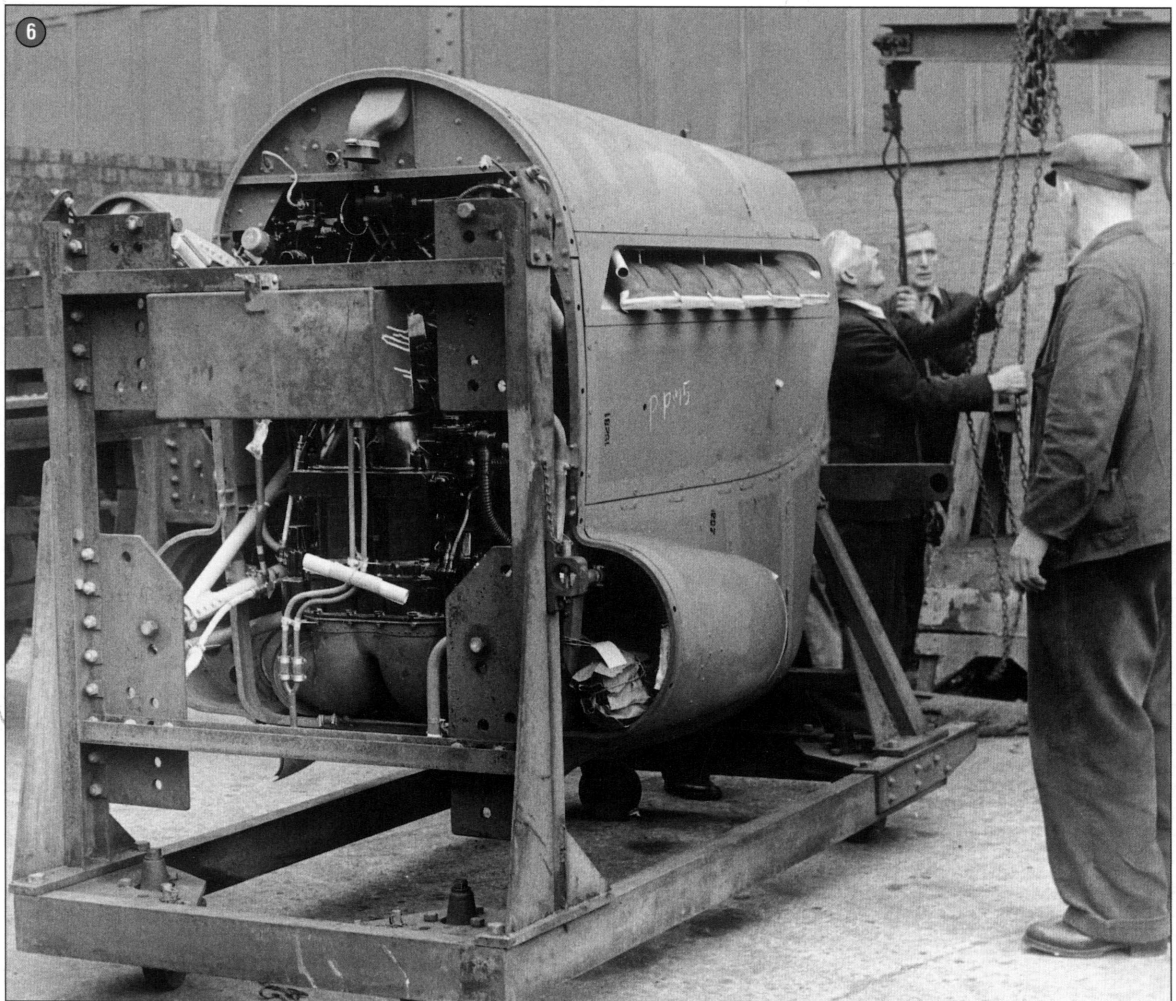
5. The Hayes Erecting Shop in May 1944. Fuselage halves started at the far end and grew into semi-complete units by the time they reached the foreground. They then moved off to the right, over to the dope shop.

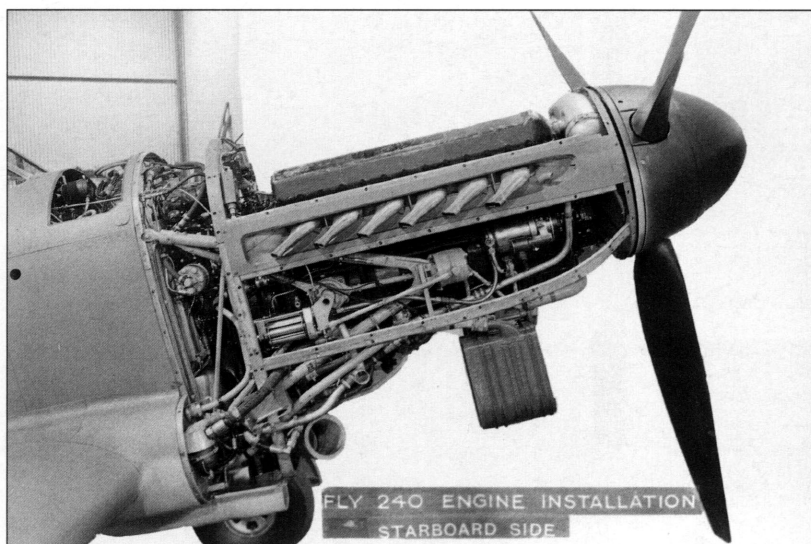


6. The arrival and unloading of Griffon power eggs outside the erecting shop, Hayes, 1944. These units are in primer Grey/Green

7. A port outer wing being hoisted at Hayes, ready to be placed on a works transport prior to being taken to the aerodrome for final assembly. This particular wing is one by General Aircraft as a sub-contractor to Fairey

8. Firefly MB565 arrives at the Great West Aerodrome in April 1945. Soon the wings, tail, propeller and other parts will be assembled ready for final inspection and a test flight. MB565 was F.7520 and was delivered to Colham on 19th April 1945





Firefly F Mk I
uncowled Griffon

The production finish was DTD 517 S, to a matt specification, with the exception of the spinner which was painted in semi-gloss Night, though as with most contracts, cellulose/synthetic enamels pre-DTD517 were to be used up first where stocks existed.

Production Delays

Some twenty-five or so of the early 'Z' registered series of airframes were put to trials purposes during 1942 in order to urge the arrival of the Firefly into service use, and the majority of these machines were in the Temperate Sea Scheme. With so many equipment modifications being introduced it was not until July 1943 that machines started to be delivered to Wroughton MU, and these, whilst containing many 'Z' registrations, were largely in the 'DT' and 'DY' series.

Production was much delayed by equipment problems with the Night Fighter NF Mk II version. Extensive airframe modifications were necessary to contain the then selected bulky but highly efficient AI Mk X (AN-APS-6) radar installation. This was to be housed in two centre-section nacelles, and with such an excessive amount of rear fuselage gear that an eighteen-inch extension to the forward fuselage was necessary to obtain a CG balance. Also extensive trials were underway to overcome the Griffon exhaust flare problems. At the last minute the US Navy demand for this radar equipment was so great that there was little prospect of anything but a long delay in receiving supplies of this set.

Attention then turned to an available, but less comprehensive AN-APS-4 installation (ARI. 5607), known more simply as ASH. An advantage here was that ASH was but a single boom-mounted pod which could be carried externally without airframe modification, and also that it relied on much less internal equipment. Easily installed in the Firefly Mk I (making it a Mk IA), production of the NF Mk II was halted after thirty-two

airframes had been completed.

Night camouflage had originally shown overall Night as the finish, but with one intermediate change, had become Dark Green and Ocean Grey, with Night undersurfaces in accordance with AL 8 to DTD Tech.Circ. No. 144, (of 31.7.42), using the standard Firefly uppersurface pattern, down to the full depth of the fuselage sides as Pattern No. 1. With the exception of roundels being omitted below the wings all other national markings were of the standard day form.

This night scheme was immediately decried by the Admiralty who pointed out from the beginning there could be no 'night-fighter only' role aboard a carrier, for such a radar-equipped machine would double in day and night roles, thus night camouflage was out. The future for these machines was in an FR. I/NF/Mk I combined role, painted in day camouflage.

Unit Markings

The first Firefly unit in service was No. 1770 Sqn. RNAS formed on 1st October 1943, at Yeovilton. Deliveries were slow and after working up, the unit flew on 18th May 1944 out to HMS Indefatigable and after two further months of training prepared themselves as both escort and additional strike aircraft against the German battleship Tirpitz.

Coding had taken on the form 'letter-numeral-letter', representing 'carrier-role type-individual aircraft letter', where the fighter role was given by '6', but during 1944, CAFO, 1431/44 had made the change for the Firefly to '4'. This was shown as 'A4A' ('A4B', 'A4C' etc.) whilst shore-based, usually with 'A' forward of the roundel, and '4C' aft of it, but at sea under operational conditions the carrier letter was removed leaving '4C', or just the individual letter 'C'. These letters were marked in Sky, though other colours had been noted, namely Medium Sea Grey, or Dull Ident Red. Codes were not always easy to appreciate as Ministry censorship often removed some characters for security reasons.

Code markings were marked by units in anything but a standard form and had not helped at all operationally, thus Air Council/Admiralty considerations were given during May 1944 (DARD Technical Circular No. 4: Old Series), to returning to something of a revised form of the pre-war numerical identity system. For those Fireflies in service in home waters it had been a fairly brief seven months and thus only very little operational experience had been gleaned, but with more units being formed some code clarification was necessary, and more so with the ending of the European War on 8th May 1944, when squadrons were being moved to the Far East and Pacific regions.

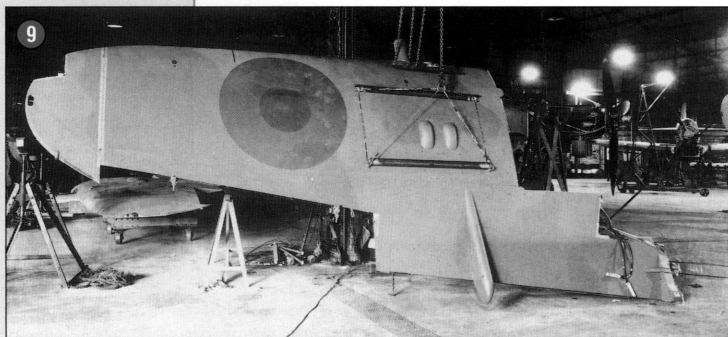
The Pacific War

Little change in camouflage took place but national markings as for those units operating with the East Indies Fleet (EIF) were soon changed. The use of any form of red was banned, thus roundels took up a white and blue form, thinly outlined in white, whilst in a short while the fin flash was removed.

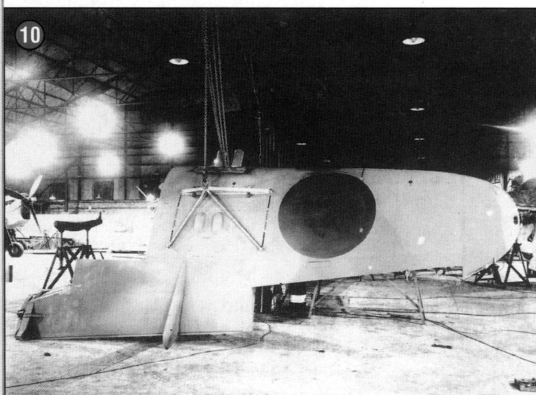
Those in the Pacific adopted by May 1945 similar markings to those of the US Navy, and where the revised Admiralty individual aircraft identity scheme of 1944 was brought into being, marked as three numerals, which for the Firefly was within the allotted sequence of '200-299' for any unit. A good example was General Aircraft Co., built by Firefly FR Mk I DK438, as '277'/'N', with No. 1770 Sqn. RNAS... the latter letter marked large on the fin, and with a small '77' marked forward on the nose cowling, all being in white. National markings initially were as for the EIF, but soon adopted the US form of white 'bar' thickly outlined in blue. On the wings the US style of 'port upper and starboard lower' was often employed and most markings were in white, as were many spinners.

Firefly Mk I, PP604 at Heston in 1945, with an experimental gloss finish. By contrast with the Corsair, the colours are so fresh and strong, that Extra Dark Sea Grey can hardly be distinguished from Dark Slate Grey in monotone. PP604 was F.6278 and was delivered to Colham, 24th June 1946

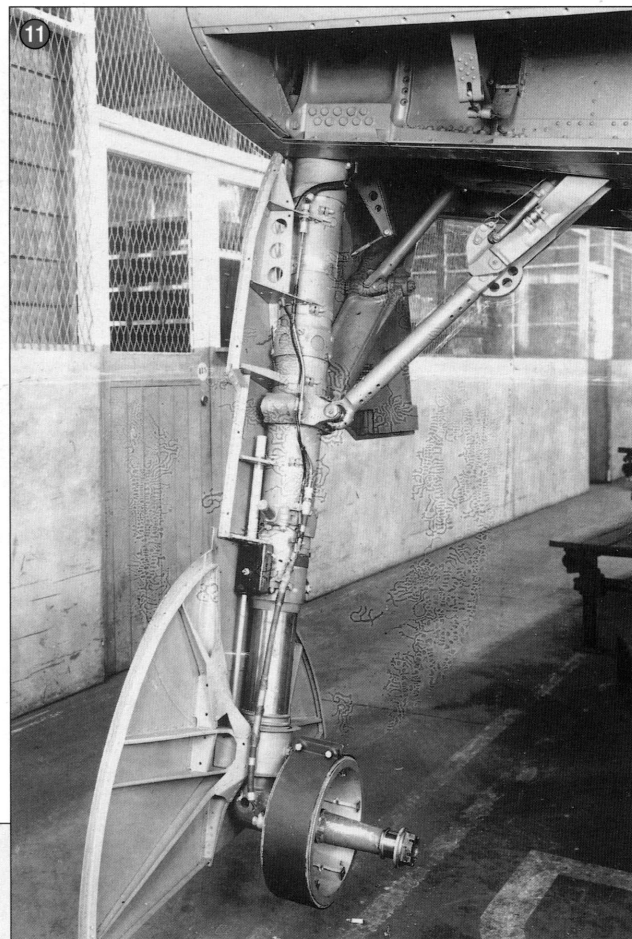




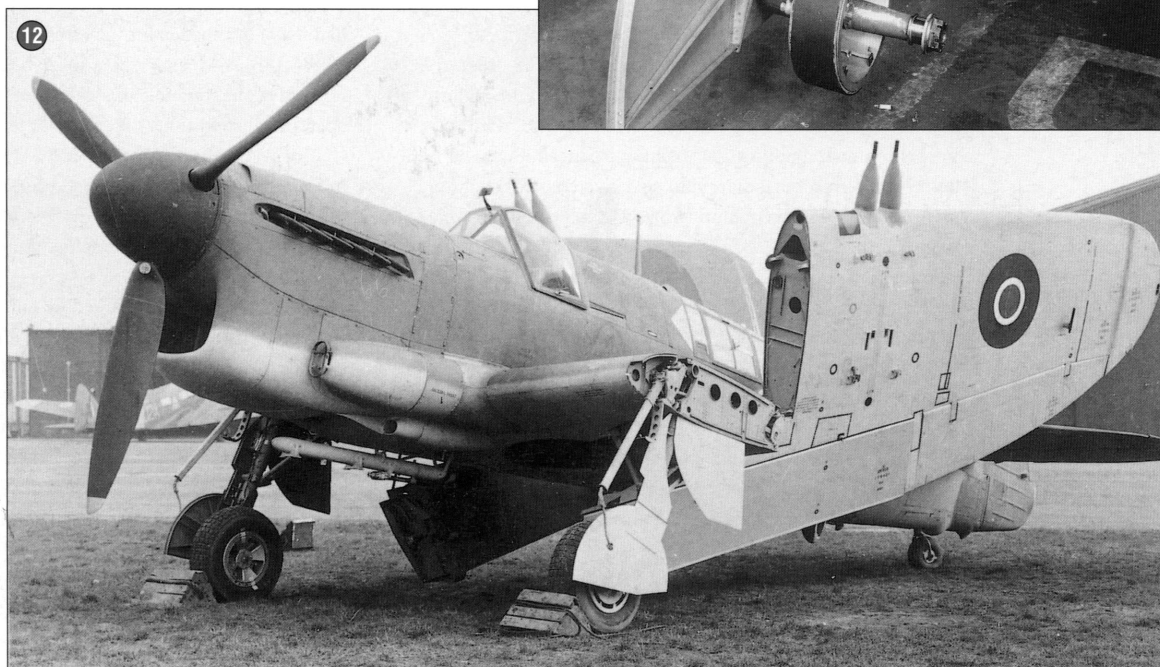
9. View in the new Firefly Erecting Shop at Heston in the Summer of 1945. A port wing unit, less flap (and where the cut back of the trailing edge area adjacent to the flap can just be seen), slung ready for attachment to a fuselage. Note the camouflage pattern



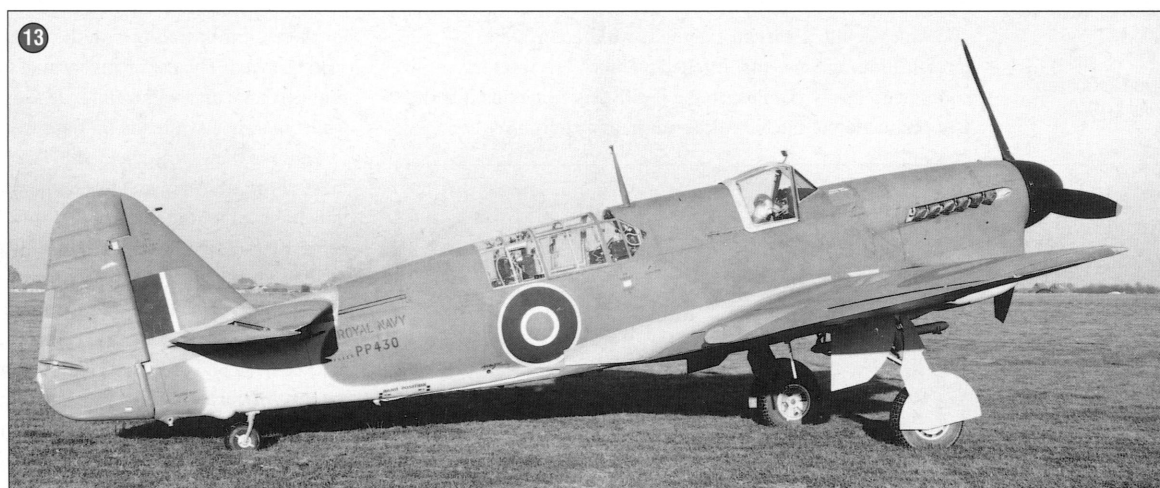
10. The corresponding starboard wing (with flap) also slung ready to be attached to a fuselage. Note other Firefly Mk Is in the background. All have the Rotol wooden (Hydulignum) propeller with the spinners not yet fitted



11. An uncluttered view of the Firefly main starboard leg. Note above the leading edge fuel tank attachment strap fitting, fixed to the front spar web. Everything here (except for chromed sliding parts etc) is in Grey/Green. This view is in the main assembly line at Hayes



12. This is PP466 at Heston late 1944. This shows typical mid-period markings below wings ...some read from aft, others from forward. Early Fireflies had one scheme. Late ones another, whilst mid had yet another. I have gone for a mid one here. This machine has the 'ASH' pod mounting pole fitted. It has a Rotol propeller (note serial data in white circle at each blade root). See also coolant detail on forward, top cowl



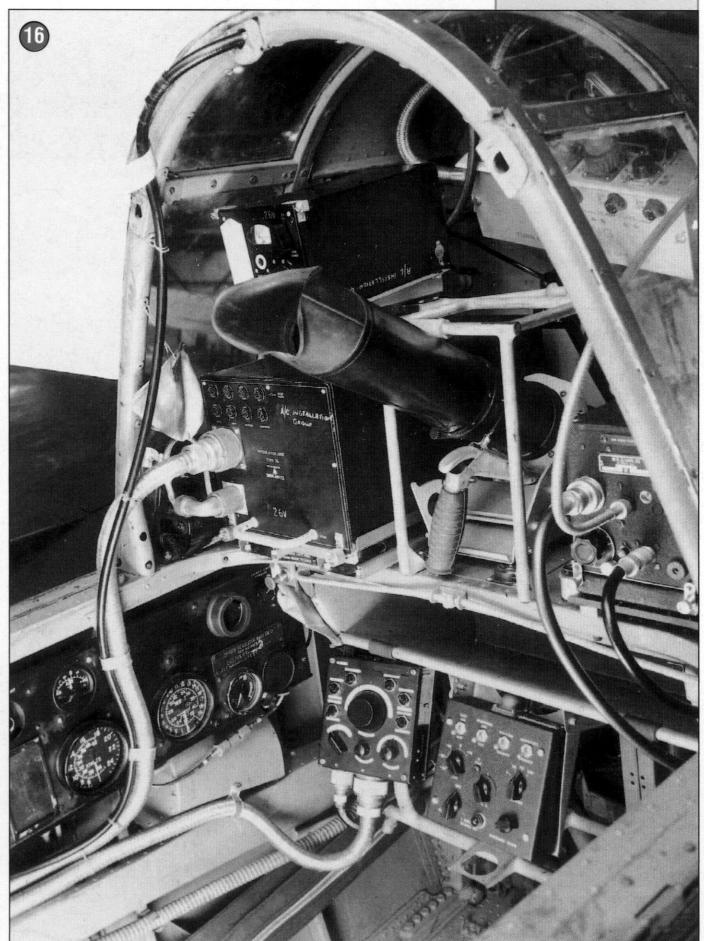
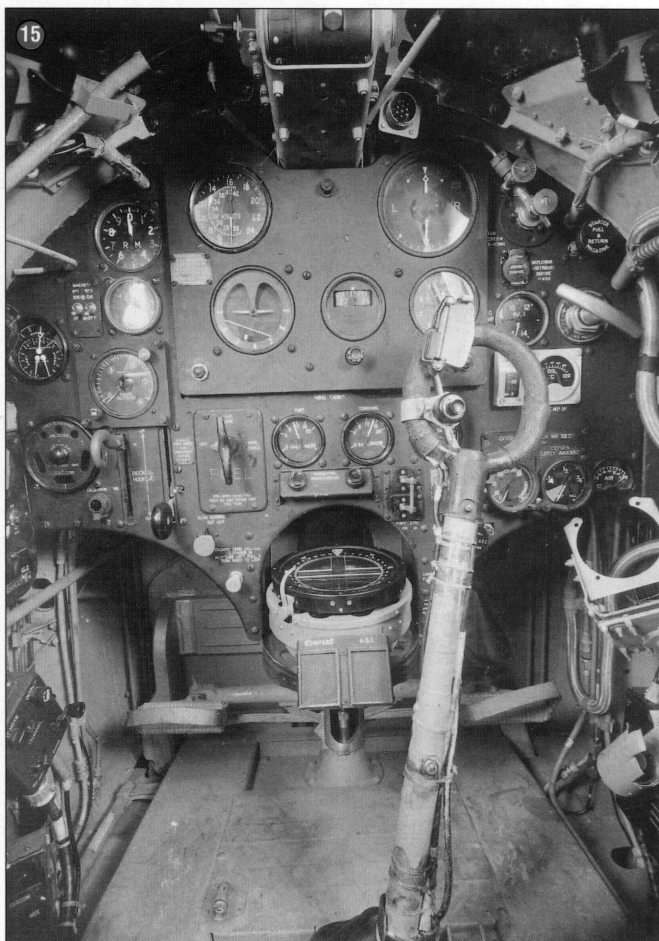
13. Firefly FR Mk I PP430 (F6159) photographed at Heston. Delivered to Colham 26th November 1945



14. Firefly Mk I early series pilot's cockpit, starboard.

15. Main instrument panel of a later Firefly Mk I, in the PP400 series which was probably delivered to Colham during October 1945

16. The observer's cockpit looking forward in a Firefly Mk I with an 'ASH' installation



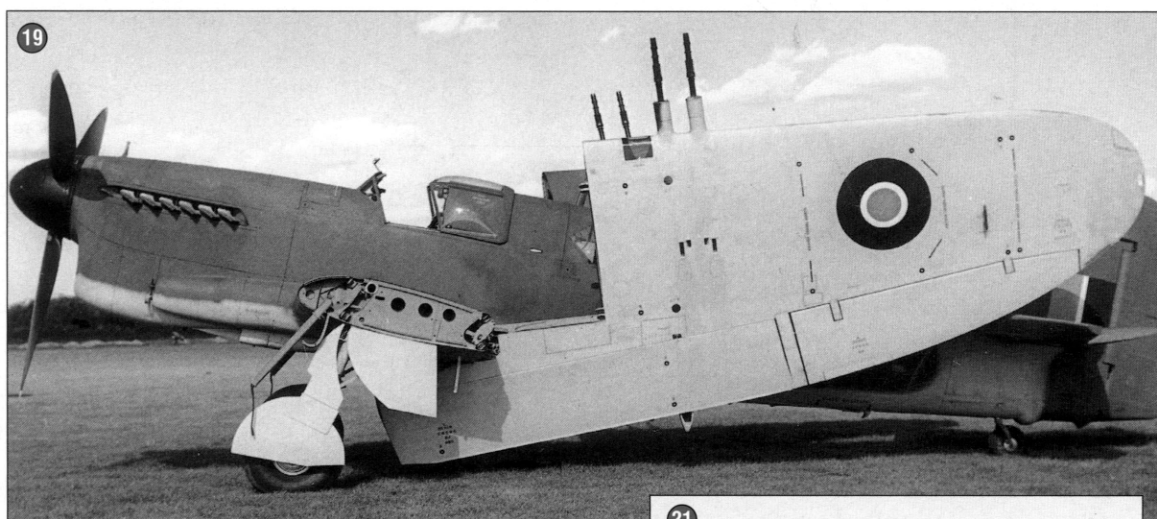


17. Firefly FR Mk I PP650 (F. 6309) at Heston, 26th February 1947. Note smooth finish paint scheme. This aircraft was delivered to Colham, 25th March 1947



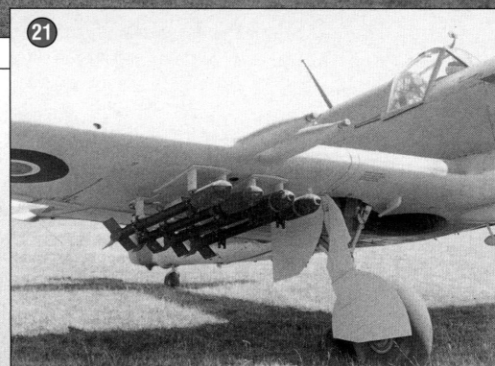
18. Firefly MK I Z2035 (F. 5009) at the Great West Aerodrome

19. Firefly Mk I Z2035 (F. 5009) at the Great West Aerodrome prior to Flt Lt F. H. Dixon giving a flying display etc, and an air-to-air photographic session with Charles Brown. This aircraft was delivered to RAF Wroughton, 8th May 1944



20. Folding the wings of a Firefly Mk I. Note the early form of rocket launch rails

21. The Firefly could also mount an 8-rail rocket bank, with 60lb heads. This is the later zero-launch installation





Firefly Mk I early series
pilot's cockpit, port

There was evidence seen at Hayes post-War of use in the Pacific of Extra Dark Sea Grey solely on the uppersurfaces (in some cases?) on the Firefly (many war-weary 'retired' airframes put into store were brought in to be used in the new Structure Test Laboratory then under construction). This may have been in imitation of the US Navy use of Sea Blue?

Post-War Changes

Immediately after the end of the European War for home based machines, the wing uppersurface roundel included a narrow white ring between the red and blue, and instructions were passed to mark the registration on wing undersurfaces.

New Scheme 1 (Author's designation): New paint scheme instructions of September 1946 in fact introduced Pattern No. 1, with the entire uppersurface area in Extra Dark sea Grey, with Sky lower surfaces. This change did not become apparent until after 1st October 1946, (AP 2656A, Vol. 1, Section 6, Chapter 1) when a few new airframes other than Fairey were noted and by which time the pre-war style red, white and blue roundel had come back on limited experimental use. Hardly had some machines appeared in this scheme when further repainting was halted until all old stocks of the two-colour camouflage had been used up.

AMO A. 413/47 (15.5.1947) officially brought the new scheme into use, and by July efforts were being made to introduce the larger central red spot to the red, white and blue roundel and in bright colours. Training aircraft were to be overall aluminium with yellow fuselage and wing banding. More unwelcome was a new style of registration characters, based on straight lines joined to pure radii where necessary. But it was not until 1st September 1947 that such changes were occasionally noted. Factually the scheme did not receive full approval and an improved scheme was called for.

Also in 1947 changes in the Night Fighter scheme resulted in one that had removed the Night undersurfaces, and involved one of overall Medium Sea Grey, with Dark Green uppersurface colouring to the standard camouflage pattern reaching down to about mid-fuselage depth. Spinners remained in Night, though Medium Sea Grey was a subsequent change. As it was evident that future fighter designs would be equipped for both day and night operational roles, there was a need for a Night Fighter Trainer, so a number of ASH equipped Firefly Mk I were formed

into No. 792 Sqn.RNAS, Night Fighter Training Unit and took up this new two-colour scheme, these machines in fact being redesignated T Mk III.

New Scheme 2 (Author's designation): The matter of an 'improved' scheme had been resolved and a new standard Naval Paint Scheme was introduced on 2nd January 1948 whereby Pattern No. 2 was introduced, where the uppersurface Extra Dark Sea Grey terminated in a horizontal line some one-third the way down the fuselage sides, (where on the fuselage), it was applied only to the decking, leaving the vertical tail surfaces in Sky. On the latter surface the fin flash was no longer applied. That area was reserved for base identity letters in Night, and for unit badges to be sometimes emblazoned. National identity markings became the restyled red, white and blue form in six standard locations. This was given in AP 2656A, Vol. 1, Section 6, Chapter 1.

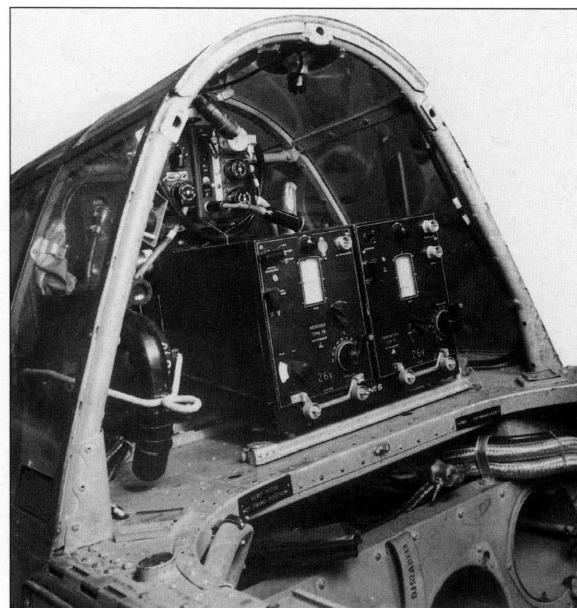
However the change of the wartime Ministry of Aircraft Production (MAP) over to the new Ministry of Supply (MOS) in April 1946 did not help to implement any matters dealing with paint scheme and markings changes, and many were not very quickly evolved and authorised, or seen in any real numbers until 1948 as influenced by numerous issues of DTD 1003 during the period 21-7-48 to 29-10-48.

One point of interest here is how rapidly Extra Dark Sea Grey faded. In what seemed a fairly short period of time the hue could become a good match for Dark Sea Grey, and this was the case when the RNAS Historic Flight at Yeovilton repainted their Firefly, and by matching what was thought to be original colour, the hue was near to Dark Sea Grey.

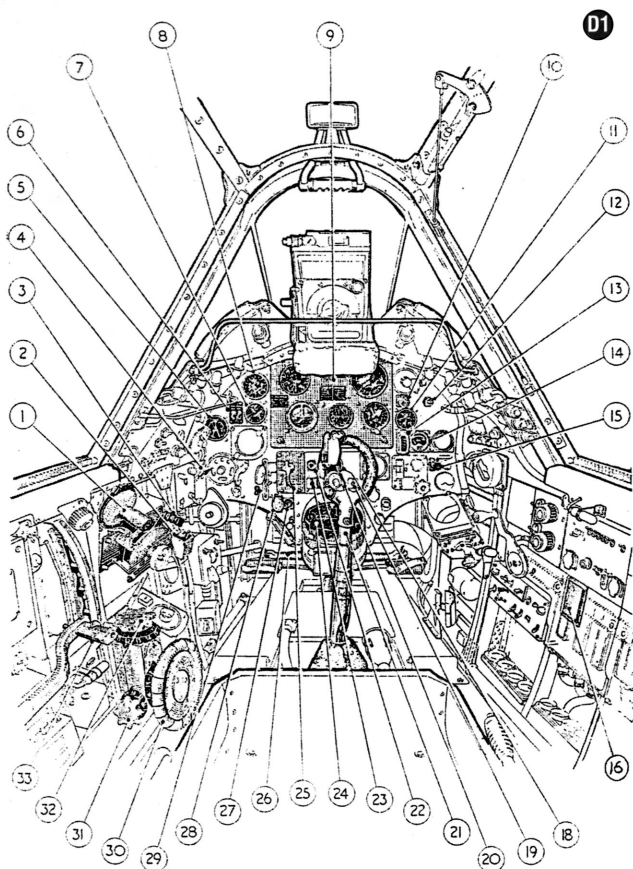
As part of this post-war change the once Grey Green pilot's cockpit interior became matt Night, where aircraft were to engage solely in night operations. This soon changed to cover aircraft engaged in both day and night operations as established after March 1948. This instruction was repeated during the years 1949 through to 1952, and finally could be read in AP 970, Chap. 100, Para. 28.1 (9-6-53).

Paint Specification Changes

There were several paint specification changes made during the life of the Firefly, as new synthetics of greater durability in the form of polyurethane and epoxy resin materials were introduced, one of the first being Dockers (CR) Epoxy Finish (8-6-49). Semi-gloss mediums were applied for trial purposes on a production



The observer's cockpit looking aft in a Firefly Mk I with an 'ASH' installation

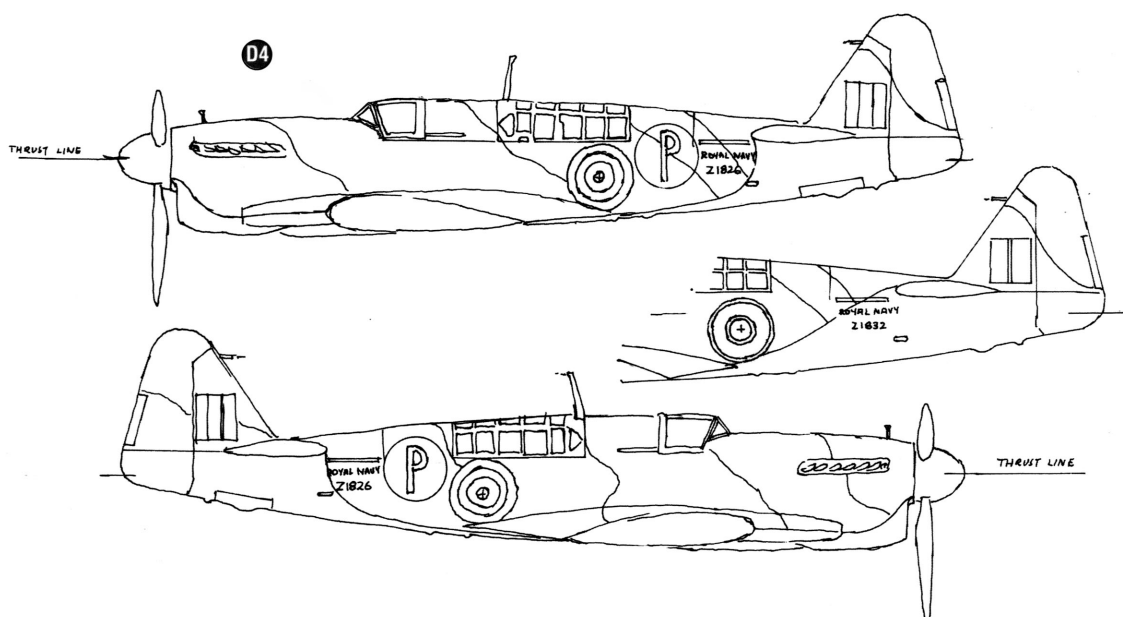
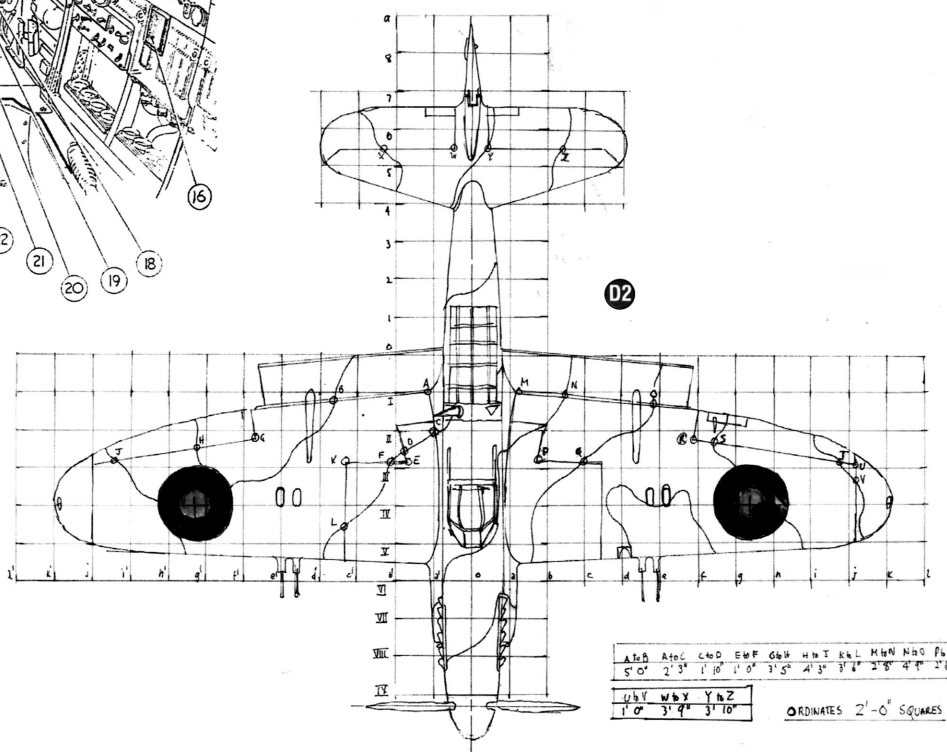
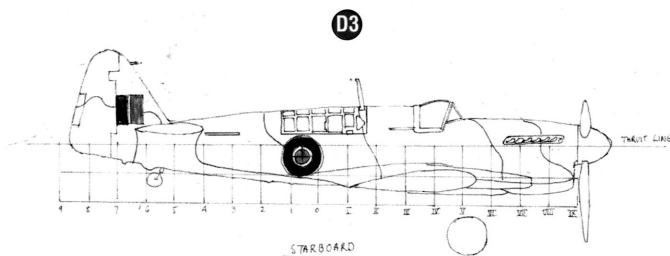
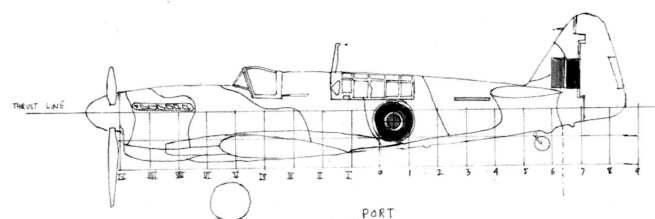


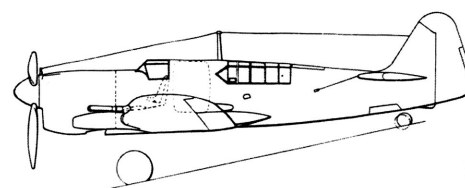
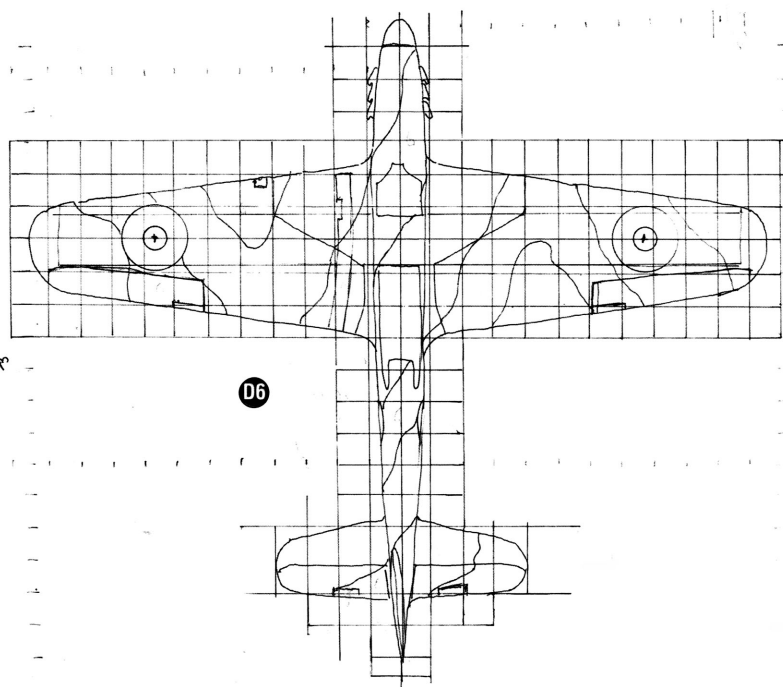
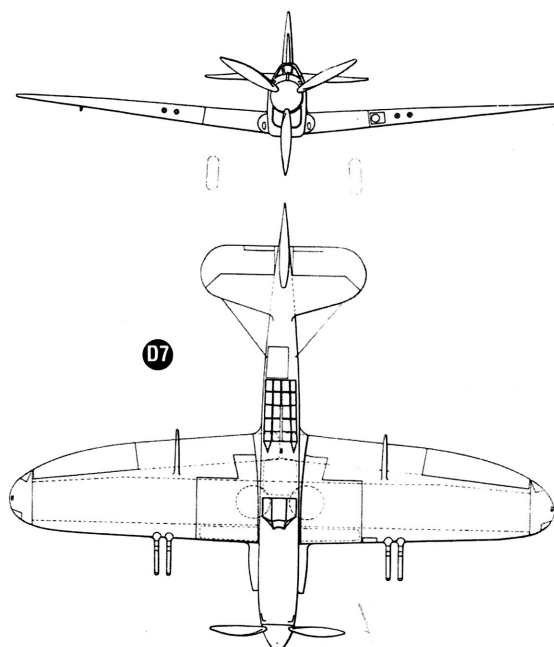
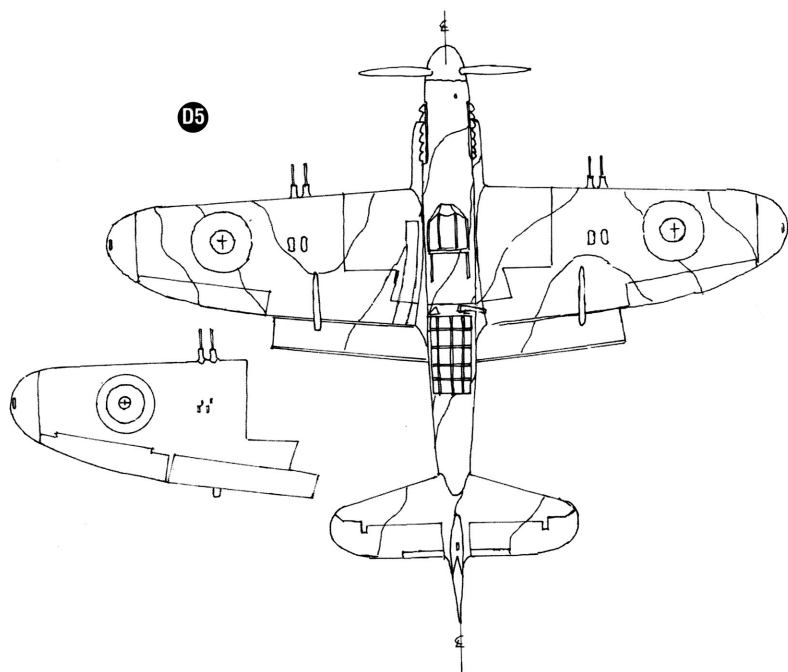
D1. Later series Firefly pilot's cockpit, probably in PP400 series, October 1945

D2. Firefly Mk I camouflage 'Z' series onwards (production series) - Plan View

D3. Firefly Mk I camouflage 'Z' series onwards (production series) - Port Side

D4. Firefly prototype and pre-production camouflage pattern - Side Profiles



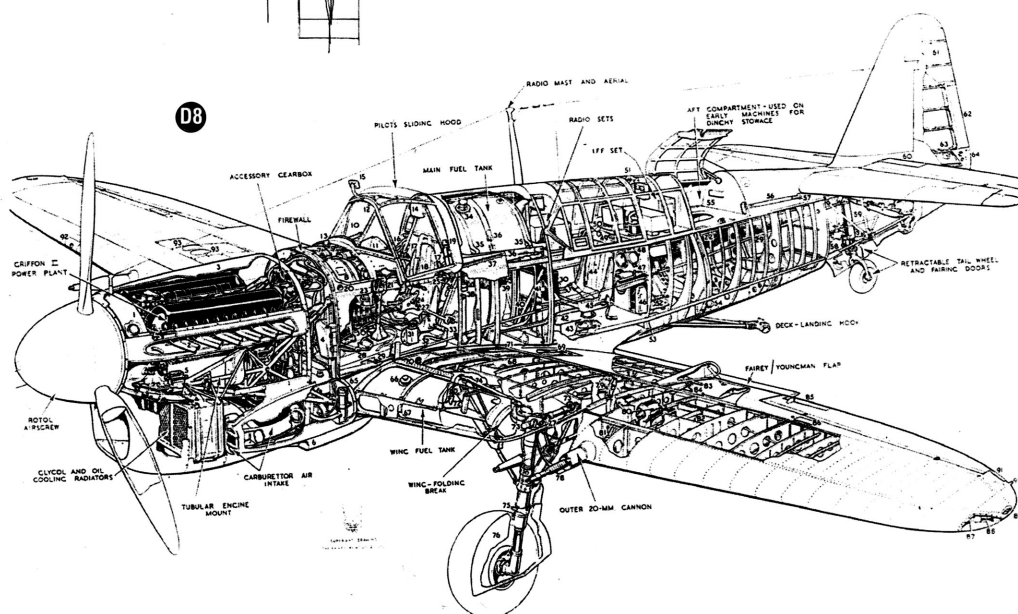


D5. Firefly prototype and pre-production camouflage pattern - Plan View

D6. 'Fulmar' basic camouflage pattern

D7. General Arrangement drawing of the Firefly

D8. Firefly Mk I cutaway



D9. Mk I and FR Mk I fuselage structure

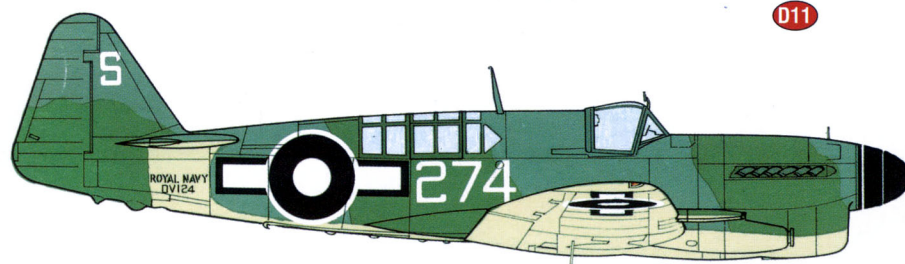
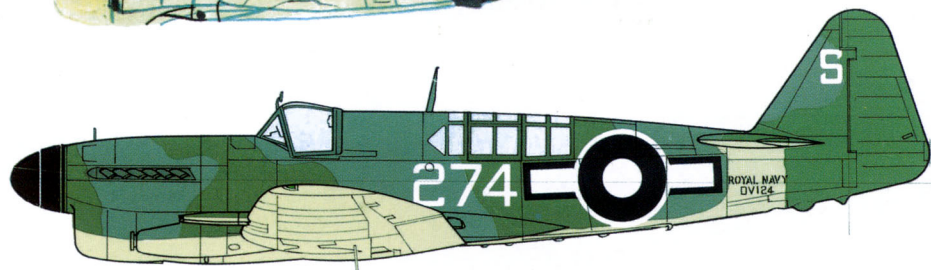
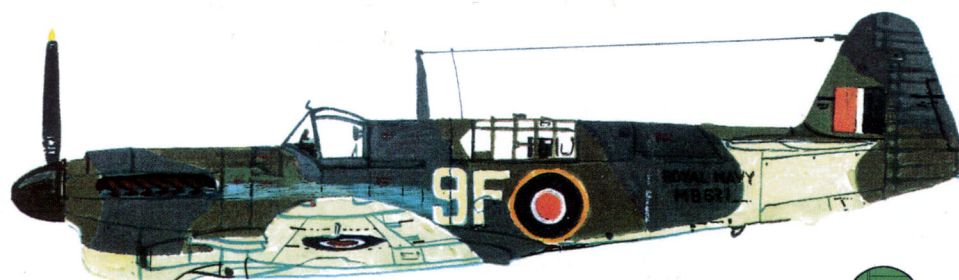
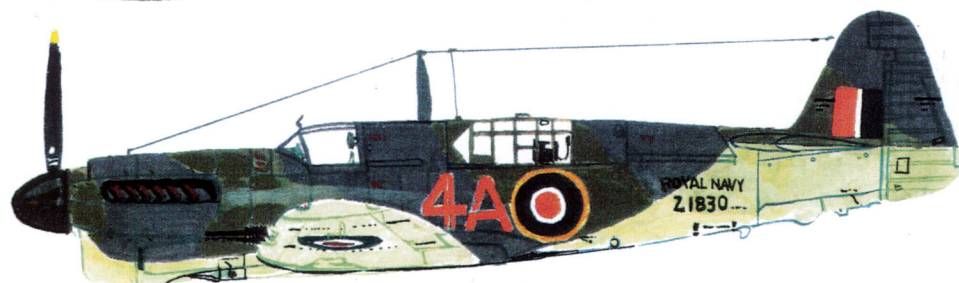
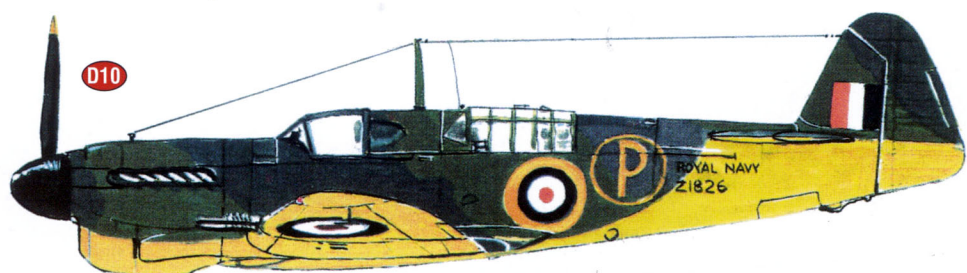
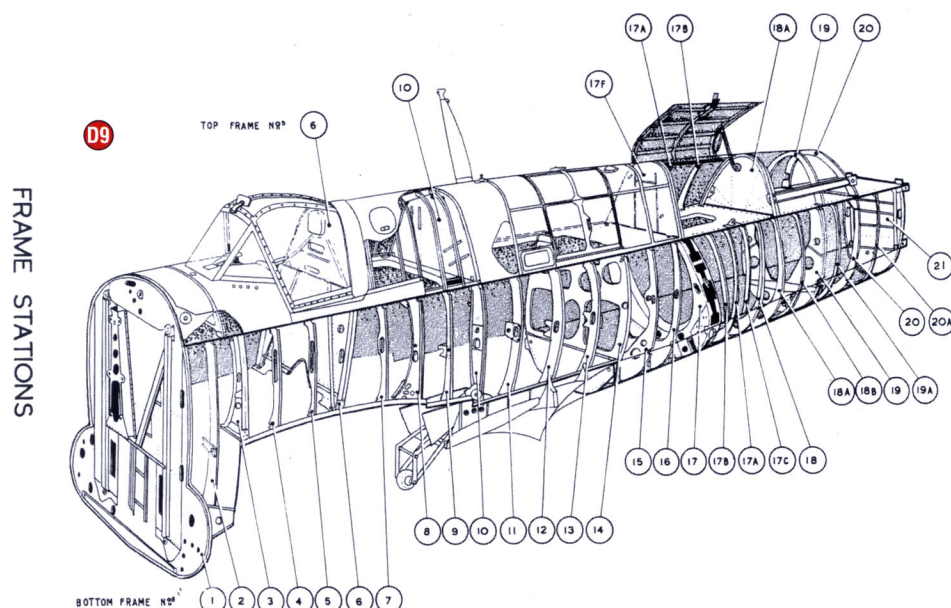
D10. Scale Colour Archive Material 1944

As an ATC Cadet, Fairey Aeronautical Engineer Apprentice No. 1500: Huntley, Ian D; was permitted to spend the week 8th to 15th July 1944 (Saturday to Saturday) at the Great West Aerodrome, Heath Row, Middlesex, on what was called 'Aircraft Instruction, General', which in simple terms meant being allowed to clamber over aircraft of various types, get into cockpits and interiors, all under the guidance of Flight Shed employees... in order to learn further....of 'shop-boy' jobs such as washing down dirty aircraft, cleaning windscreens and transparencies, assisting in compass swinging, reloading Coffman starters, and any other rough job that was going. One of the excitements was to meet Test Pilot, Flt Lt F. H. Dixon, who imparted some brief flight data and flying characteristics of the Firefly Mk I... but unfortunately no flight in one!

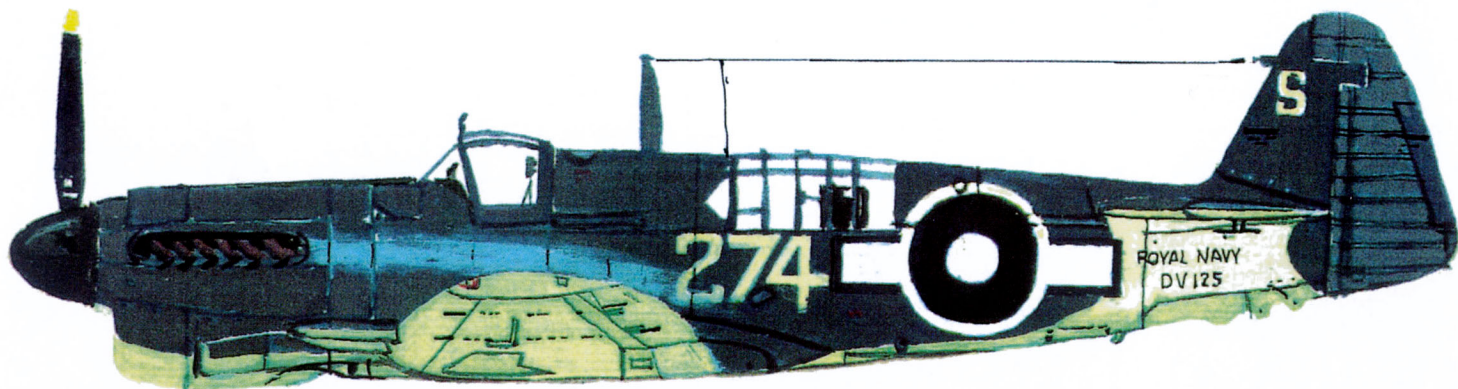
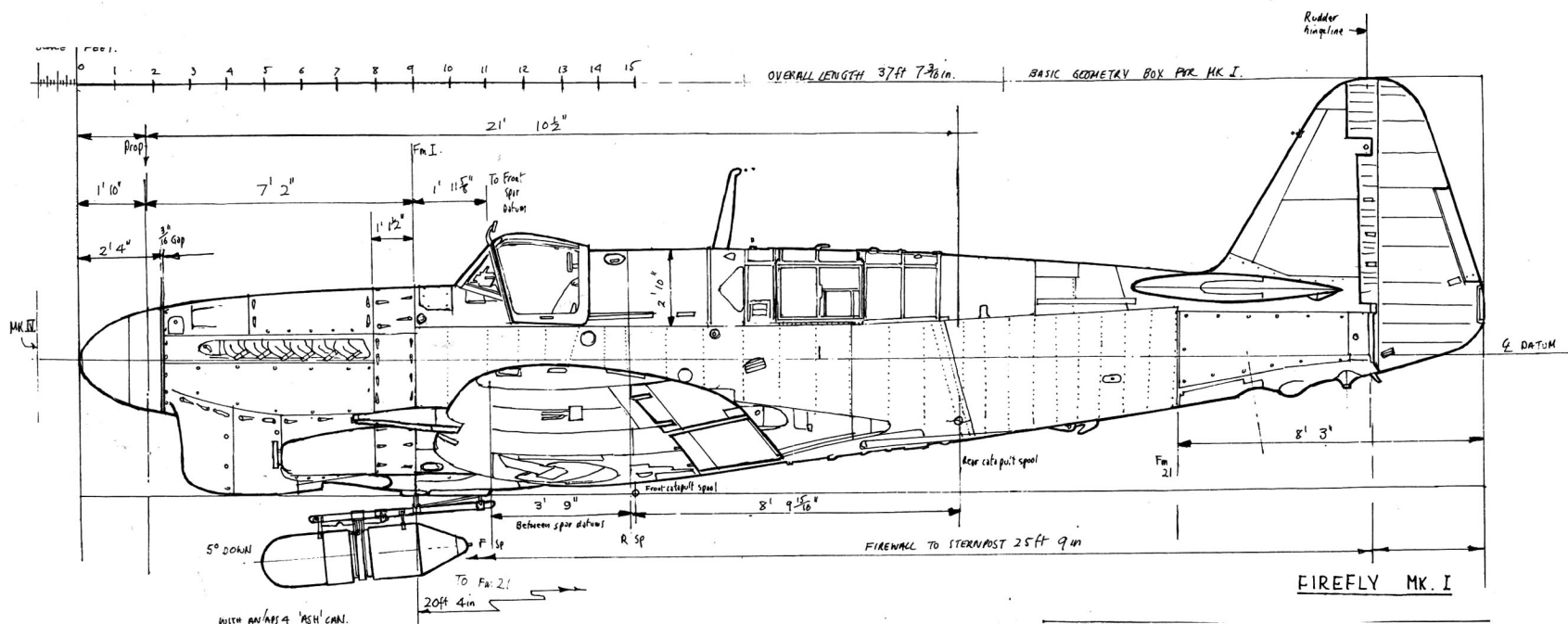
Like any other visit to an RAF/FAA Station with the ATC, there was plenty of scope to absorb colours and markings details, and after making mental notes of such detail of all Fairey aircraft there, including visitors such as the Beechcraft Traveller, a colour sketch session followed once back home. The first sketch was that of illustrating prototype Firefly Mk I as it would have looked wearing Temperate Sea Scheme with its yellow under surfaces, as opposed to its original Temperate Land Scheme colouring. The second sketch was of a pre-production Firefly with the early standard Temperate Sea Scheme, whilst a third colour sketch was that of the later production Temperate Sea Scheme. All were at that stage only in side elevation.

There was access to ACTUAL PAINT, thus the sketches were made using near matching water colour mixes which was thought a big deal at the time, but in later comparison with aircraft viewed a distance away the colours were far too saturated and dark. There was a reminder of my father's colour sketches of the past, and in making comparisons came the personalisation that ...'colour had to be scaled down in hue with distance'... and it saw the beginnings of an approach to 'Scale Colour', which was not fully perfected until 1945-1946 when my Fairey apprenticeship took me to Heston airfield for two years, when the scheme was finally mastered. The original sketches were though worth preserving for this very reason, though for reference purposes these copy prints are more durable.

D11. The sweep down of Sky aft of the tailplane went a little amiss as shown, though Hayes did become a little slack in this area with late series Mk Is

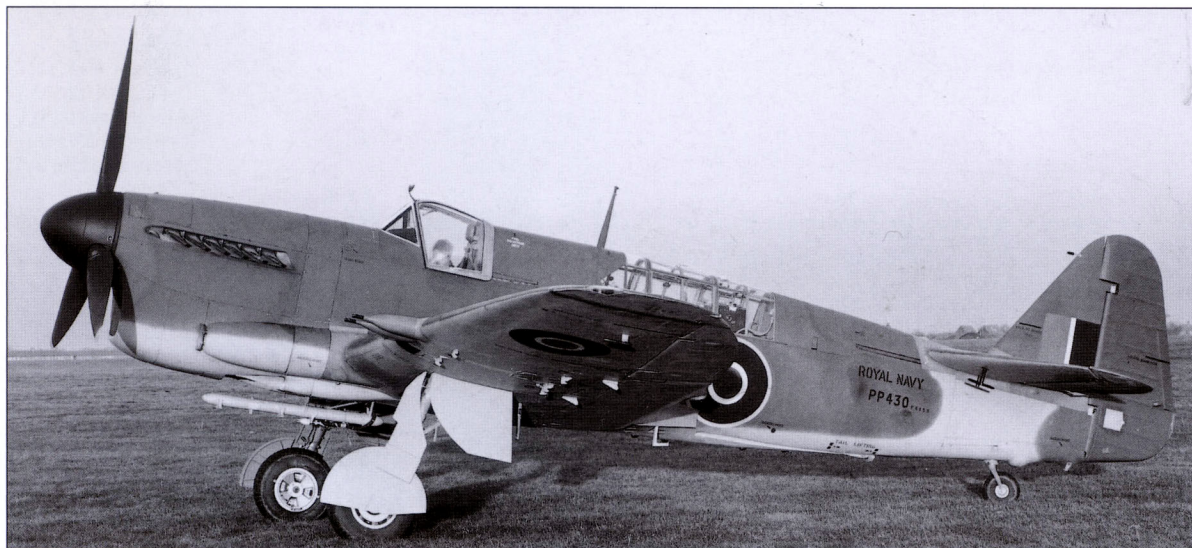


D12. This colour sketch was made at Hayes during late 1945, and was made along similar lines to those made during July 1944, following the week at the Great West Aerodrome and was based on a reference stemming from the Pacific Theatre that some Firefly Mk I operating with the US Navy had adopted the single colour of Extra Dark Sea Grey for the upper surfaces? This was unconfirmed until some spare airframe components were taken from Naval store and dispatched to Hayes for use as dummies for mounting with the new Structural Test Laboratory then under construction. Such components appeared not to have been repainted or altered in any way since last seeing service? Could it be that this scheme was a reality? The other markings were then added for a Firefly flown by Sub Lt. (AO C. D. Maclaren RNVR when with No. 1770 Sqn, RNAS, aboard HMS Indefatigable with the Pacific Fleet. This same aircraft was later used as the basis for a four-view colour GA illustration by George Burn where he made use of standard Temperate Sea Scheme colourings



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Mk I, PP604 and were compared with PP430 in matt finish, which gave the former an extra eight to ten knots speed over the dull matt finishes. [Such paints were aimed at late production Mk Is but they could not be fully introduced until the Mk IVs emerged, or in post-war days when Mk Is were to adopt the new FAA scheme].

DTD 517 S gave way to DTD 772 C, followed later by DTD 899 S and DTD 900 S series of two-part, cold catalysed, ester-resistant gloss materials. Also in this series were heat-resisting finishes, and those designed to give matched colour over radomes and aerials.

New Identity Codes

A not entirely new, but expanded numeric form of the Pacific Fleet individual identity scheme was introduced following 1st September 1947, though not much seen until 1948, where a combination of three numerals gave coded identity. The first figure indicated the class of the aircraft; the second and third figures were allotted to individual aircraft by the Air Group Commander, or by the parent Air Station, if aircraft were not organised as an air group.

Numbers were allotted according to 'Class' blocks (ie., the number of engines etc.), and those for single-engine, two-seat aircraft fell between 200-299. Thus Firefly FR Mk Is were allotted numbers in the '200' series. Aircraft still wearing the wartime standard camouflage and markings, as was a common case, mostly marked the numerals in white ahead of the fuselage

roundel, whilst the ship letter was put in the area available above the fin flash, also in white. This could be seen on Firefly FR Mk I, PP405 [?] (F6134), as '219' of No. 816 Sqn. RNAS, on board HMS Ocean in 1949.

At the same time the aircraft base ie. parent ship (or air station) was identified by single or double letters marked in as large a size as possible on the fin. Firefly FR Mk I MB500 (F7467) of May 1945 vintage was repainted in the new pattern No. 2 scheme, as during 1951 when serving on board HMS Illustrious ship's flight as '201' marked aft of the fuselage roundel and with a large 'D' on the fin. It also carried a reproduction of the ship's crest on either side of the nose cowl, centrally below the exhaust manifold.

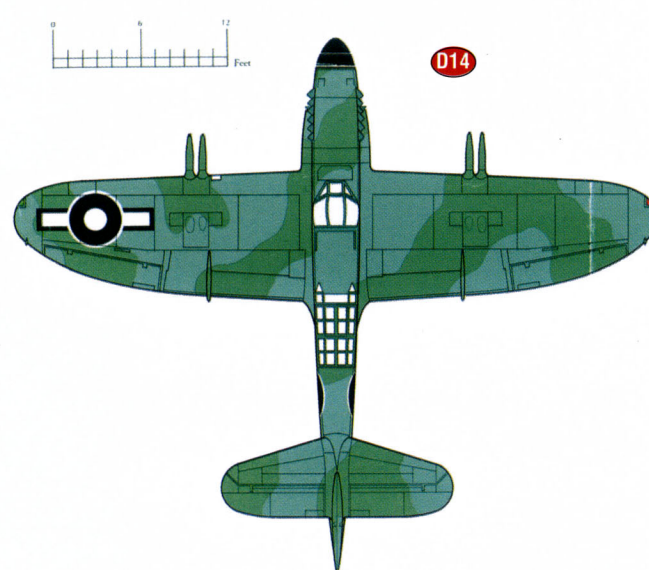
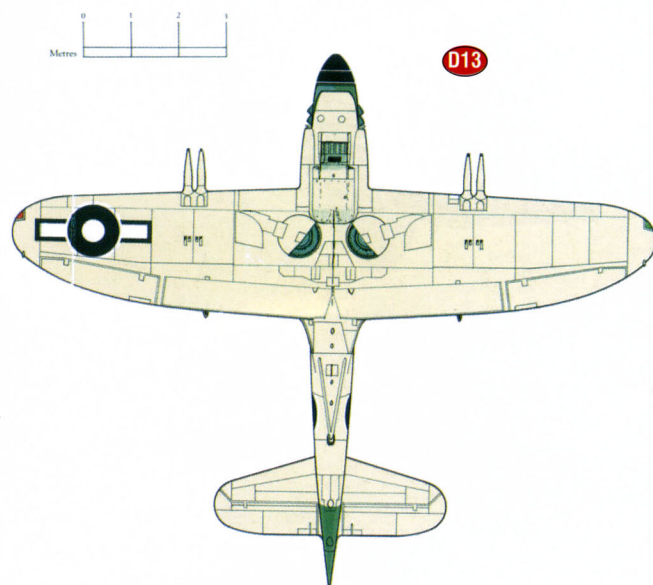
Airframe Stencilled Details

The Firefly from the start came in for a large number of small stencilled markings and these were to grow in number as time passed. These varied from the 'F' number marked below and to the right of the fuselage registration to the standard 'factory inspection code (F8), component serial, and paint finish group' on each sub-assembly, with a host of diverse markings in between, including 'fuel grade', 'locking board', 'band position', 'jack here', and 'electrical' together with many symbols, instructions, coloured screw-heads, bordered panels, rigging point, dihedral board, levelling board and beam jacking letters, a few of these markings being illustrated here. **MAM**

22. A later series Mk I at Heston in 1945. PP430 (F. 6159) sports the mounting for the original 'ASH' can, AN/APS 4, radar unit. Aerials for the radio altimeter can be seen beneath the port tailplane. The matt finish is still in use. Yellow stencilling below the main fuel tank filler reads "FUEL-100 OCTANE- ONLY" in three lines

D13. George Burn made use of accurate scale plans and as much camouflage and markings data as he could gather. One of the difficulties was in the printer arriving at a satisfactory ink mix which was a close match to scaled down original colour, and this did not always meet the requirement. This Firefly Mk I print was perhaps a little too pale, but it went some way in demonstrating the scale colour effect and it was unfortunate that the wingtip lamp colours became transposed. Sky should have been applied aft at least to the rudder hinge line

D14. Fairey Firefly FR Mk I, No. 1770 Squadron, Fleet Air Arm, HMS Indefatigable, 1945 flown by Sub Lt (A) C. D. Maclaren RNVR





General view of the
L-60S

The L-60 Brigadyr

by Paul Rigby

The L-60 is a light three-four seat, high-wing strut-braced monoplane with a single engine. It has experienced a fair amount of success both in its home country of Czechoslovakia and abroad as exports. It was built by the Czechoslovak Aircraft Works (Ceskoslovenske Zavody Letecke) and first appeared during the mid-fifties. The outstanding aspect of the L-60 is its versatility, covering wide areas of aviation such as military, agricultural, aerial photography, air ambulance, liaison and so on. Obviously, modifications have to be made to accommodate these contrasting roles. The military version, for example, has a crew of three, opposed to the civil option of four, with the pilot being joined by a wireless operator and a rear gunner who sits by himself at, unsurprisingly, the rear of the aircraft. The agricultural version normally carries a tank of chemicals and spray bars or a hopper full of chemical dust which the pilot has under manual control. A large variety of agricultural options had made the L-60 a popular choice. Other jobs include forest fire-fighting and seed-sowing.

Structurally, the L-60 carries a straight metal, two-spar wing with fabric covering between the spars and double-slotted flaps. The wing has the option of fixed (agricultural) or movable (military) leading edge slots. The all-metal monocoque fuselage has oleo-pneumatic supported landing gear with low pressure tyres which are ideal for use on rough ground and other semi-prepared landing strips.

In Kit Form

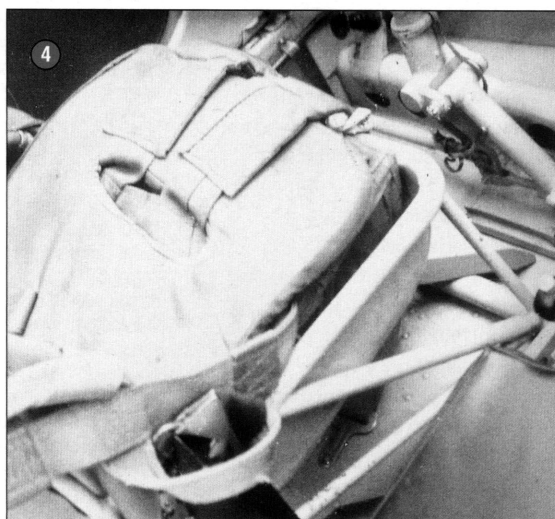
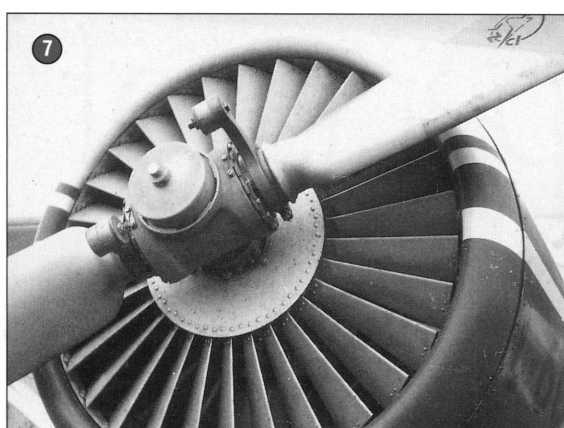
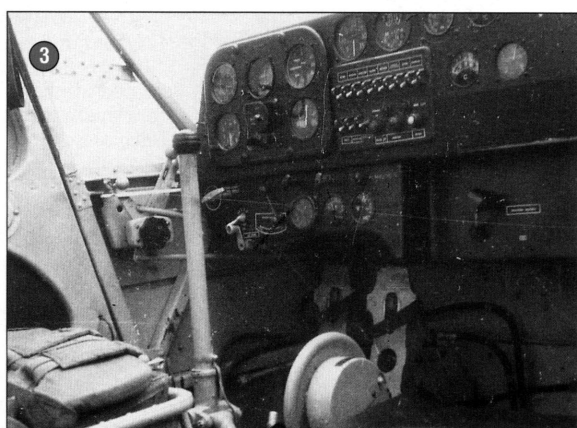
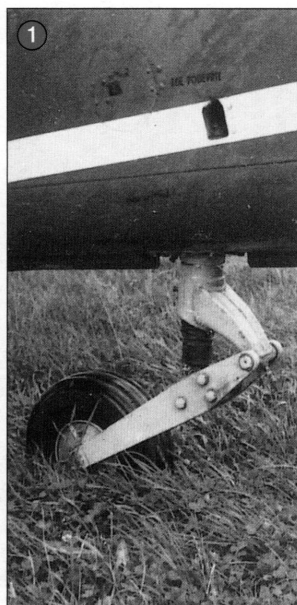
The L-60, to the author's knowledge, has had only one kit to represent it, which I suppose is one more than we should have a right to expect, and this is from VEB Plasticart. The kit was produced to 1/100th scale and was, to my memory, of the usual VEB standard, e.g. basic. However, it was, and still is, an excellent basis to build on. With kit companies producing relatively little in the 'light-civil' area it is a kit to look for. In fact 'hunt' may be a more appropriate word because VEB kits in

general have been arriving in the UK rather erratically and under various names. In the March 1988 issue of *Scale Models* we heard from readers who had seen the VEB series selling under the Playfix label. I, too, have seen these kits being sold in newsagents and the like, as well as official VEB kits re-appearing in my local model shop (the L-60s were hastily snapped up though). There were, unfortunately, problems with further importing of the Playfix kits. The British company involved ran up against officialdom who have criticised, specifically, the inclusion of glue within the kits (a standard VEB practice). Whether the trouble is due to the principle of including glue within the kit or the way the glue itself is packaged, is unclear (It is probably relating to the hazard the glue represents, or the fact that the kits are being sold as toys - Ed). What is clear is that the British importers had to remove all glue from their remaining stocks to satisfy the UK regulations.

So the question begs, where else can you get the VEB L-60? Check your local model shop, especially its darkest corners - you never know what you might find! **MAM**

View of the undersurface of the starboard wing. Notice the fixed leading edge slots. Also of note are the three supporting struts and cabin door. The pilot's headphones can be seen hanging inside the cockpit





1. The tailwheel, as well as the main undercarriage, had pneumatic shock absorbers

2. Within the cockpit shot can be seen the foot straps connected to the rudder pedals. To the lower right of the picture is the trim wheel

3. A broad view of the instrument panel with the throttle quadrant to the left. The control stick appears to be a simple affair.

4. The pilot's seat with a suitable array of seat belts

5. The novel aspect of the rear canopy is that it hinges down for ease of loading and unloading. A feature that has become invaluable in the ambulance version

6. The starboard view of the nose area also give a good aspect of the main undercarriage and the low pressure tyres

7. Detail shot of the propeller and engine. The author is aware that the agricultural version carried the Praga Doris M-208B six-cylinder air cooled engine giving 220hp. However, this was an in-line engine. The 'S' version has a radial variant, which is unknown to the author. But I suspect that it is either the 315hp M462 RF nine-cylinder air-cooled engine or the older Ivchenko AI-14RA nine-cylinder engine of 260hp. Are there any enlightened readers out there?

Thanks
All the photographs were kindly supplied by Milan Travnicek.

Specifications

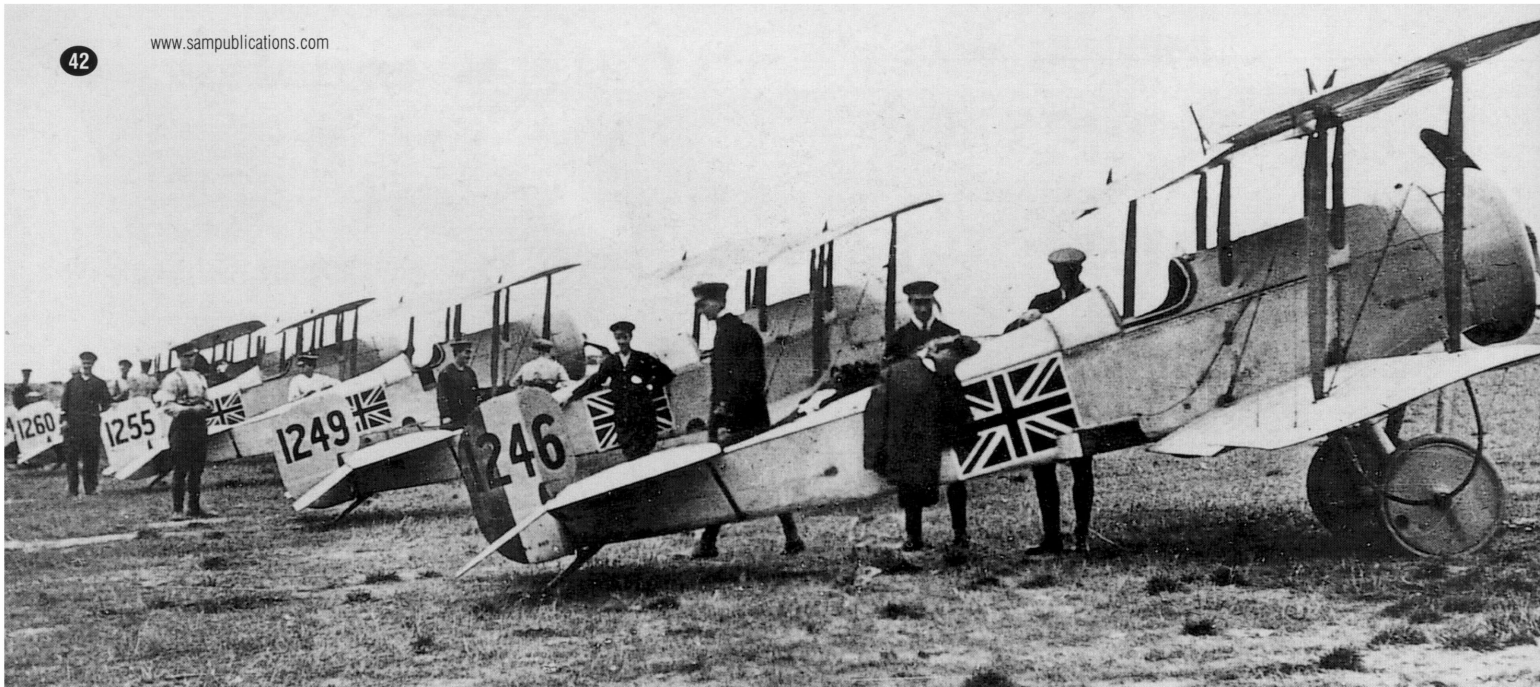
Dimensions:

Span	45ft 9.5in (13.96m)
Length	28ft (8.54m)
Height	8 ft 11in (2.72m)
Empty Weight	2,134lb (968kg)
Normal Weight	3,219lb (1,460kg)
Max. Weight	3,439lb (1,560kg)

Performance:

Max Speed	120mph (193kmh)
Cruising Speed	109mph (175kmh)
Service Ceiling	13,780ft (4,200m)





Aspects of the Bristol Scout

by Harry Woodman

During the months immediately preceding the outbreak of WW1 three British aircraft manufacturers produced their own versions of a novel type of aeroplane, a single-seater usually described as 'fast sporting biplanes' by the aviation press. All were diminutive and all were powered by the 80hp Gnome. Sport flying in those days was a new activity which appealed to those younger members of society who could afford to buy these expensive (and sometimes dangerous) new toys.

The three aeroplanes were the Sopwith, (given the name 'Tabloid'), the Martinsyde and the Bristol 'Scout'. The Sopwith and Martinsyde resembled each other, both had four-wheeled undercarriages and froglike noses housing the engine. The Bristol was more elegant employing what was to become universal, a rounded cowl and a 'V' undercarriage. However, the original version exhibited at Olympia in March 1914 had a rather silly very narrow undercarriage track and virtually no dihedral. The cowl had a blind front, a serious error for rotaries needed all the air available. However improvements were quickly made and the diminutive biplane now with its open cowl emerged and was dubbed the 'Bullet', a name applied to almost any small fast aeroplane until the familiar name 'Scout' became standardised.

During its service with the RFC/RNAS/RAF it appeared in various forms as the Scout A, B, C and D powered by 80hp and 110hp rotary engines. Unlike the Sopwith and Martinsyde the Bristol remained in service until the end of the war, from mid-1916 onwards as a trainer or as the CO's personal runabout. It was during its two years as an operational machine that it has earned its well deserved niche in military history.

The term 'scout' was an old military term, the original scouts being cavalry men who were the eyes of the army in the days before balloons, dirigibles and aeroplanes, to the annoyance of

elderly cavalry officers, many of whom held senior posts in the British Army.

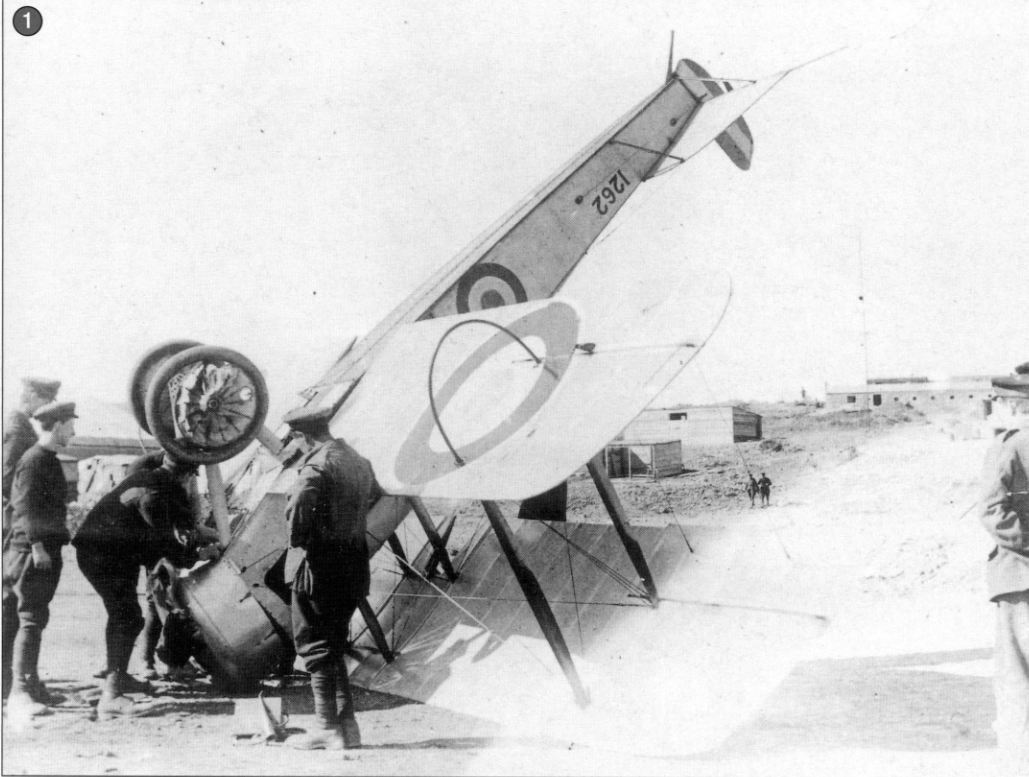
It was some time before clearly defined tasks for aircraft and units were established other than the early vague 'general reconnaissance'. Early military aviation units on both sides often consisted of machines of different types and it was a common practice to have single-seat scouts on the unit strength.

In some cases individual airmen with a determination to do more than just shoot pistols at the enemy armed the Scout with a rifle and a collection of grenades and then when it became available, a Lewis gun. It is probable that because of these aggressive activities that the description 'Scout' became the official term for the single-seat fighter in British service; the description 'fighter' came into use later. In French, German and Italian service the name given to the single-seat machine gun armed aircraft was 'hunter' whilst the Americans preferred the appellation 'pursuit'. During its use by the RFC and RNAS the Bristol Scout was armed with virtually every form of weaponry available. This covered pistols, stripped rifles of various types,

Type C Scouts at Eastchurch in June 1915. Note the box for incendiary flechettes (inflammable steel darts) on the lower wing with release cord. Previously this item has been incorrectly described as a Ranken dart container. RNAS No. 1246 also has a rigid simple mount on the upper wing for a Lewis. RNAS No. 1255 in the line was flown by Flt Cdr B.F. Fowler when he made the first take-off from a carrier ship (HMS VINDEX) with a wheeled undercarriage whilst the vessel was underway. The mixed markings of this period are notable

Bristol Scout B, one of a pair at Farnborough in August 1914. Eventually the pair with RFC serials 644 and 648 went to France. The former was allocated to No. 5 Squadron but written off in November whilst the latter went to No. 3 Squadron, then No. 4 and eventually to No. 8. Note the early position of the underwing skids, the position varying with later models





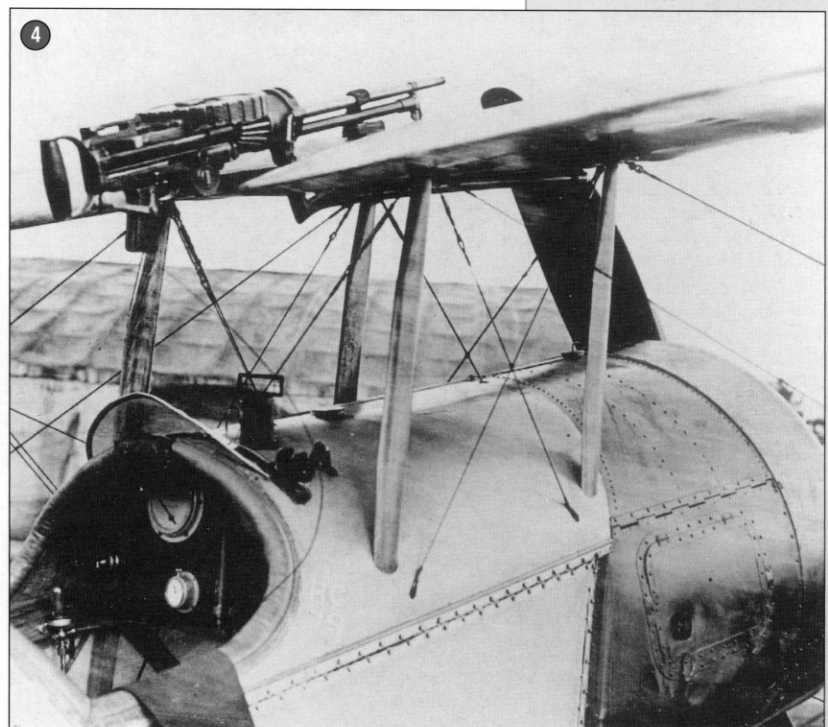
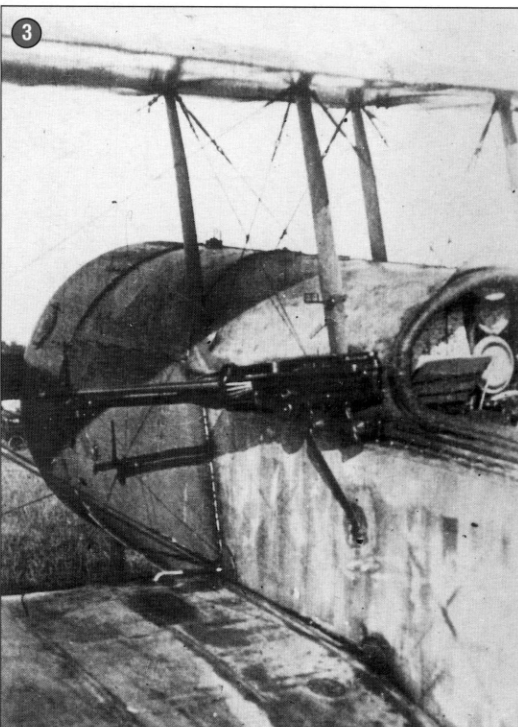
1: Scout C RNAS No. 1262 in an undignified position. This Scout was despatched to No. 2 Wing RNAS on the island of Imbros in August 1915. This photo was taken on January 18th 1916 when Flt Sub Lt F.D.H. Bremner performed this unfortunate landing. The machine was repaired but was crashed again in March leading to its being struck off charge. (Barry Gray)



2: Bristol Scout C RFC serial 1611 flown by Captain L.G. HAWKER DSO of No. 6 Squadron. In this machine Hawker attacked three enemy aircraft, shooting one down in flames on October 22nd 1915. He was subsequently awarded the first VC for aerial combat. His achievement is remarkable considering the single Lewis mounted at an angle to clear the propeller with only a 47-round magazine. Note that there are no roundels on the upper wing and the machine is not in the squeaky clean condition as suggested by artists (T. Hawker via Barry Gray)

3: A close-up of Hawker's Scout and the Lewis gun arrangement on its three-legged mount. Note the folded map in the map case, a standard fixture (T. Hawker via Barry Gray)

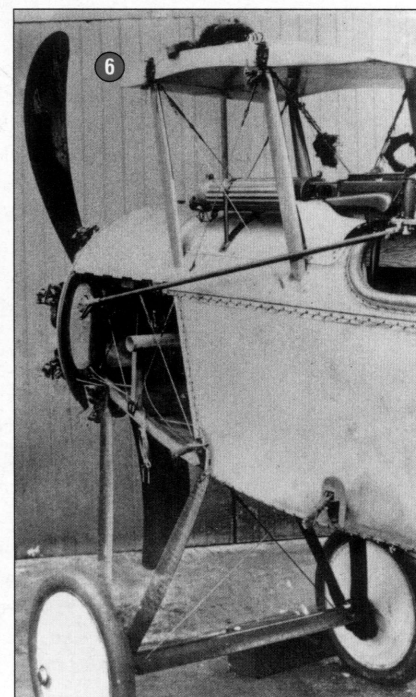
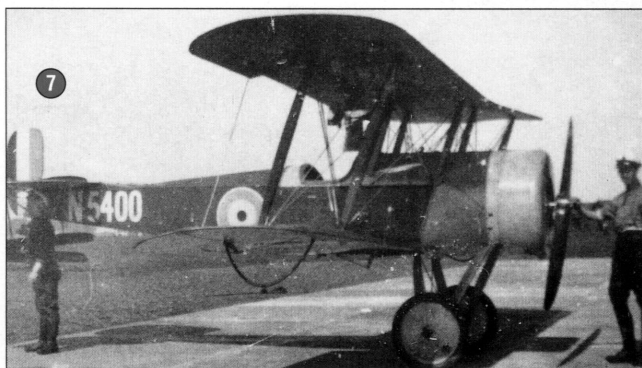
4: A Scout C at Farnborough in March 1916 and an excellent close-up of the overwing Lewis on a simple 'gas pipe' mount which permitted lowering to reload. Note the clip in front of the windscreen to hold the Lewis handgrip when lowered. Also apparent is the small gate-sight and the cable for firing the Lewis from the cockpit. The instrument panel changed little during the Scout's period in service but the basics seen here were typical. At top is the ASI, the central vertical glass tube is the fuel indicator and at right (not seen) is an altimeter. Lower down is a watch and throttle at left. Note the lacing and the piano hinging of the metal cowl panel



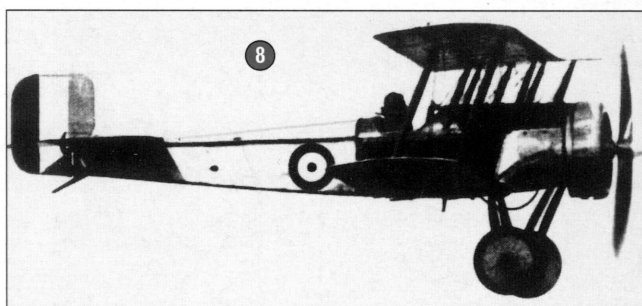
5: Scout D RNAS serial N5393 of No. 2 Wing Imbros probably in early 1917. This was a batch powered by a 100hp Gnome Monosoupape. In addition to the usual overwing Lewis this machine has an additional gun fixed (perhaps two) firing forward without any synchronising gear. It was not uncommon to permit this practice in the RNAS, a few bullet holes in the propeller not being considered over-hazardous at the time. The blade tapes were meant to diminish the effect of self-inflicted hits (J.M. Bruce/G.S. Leslie)



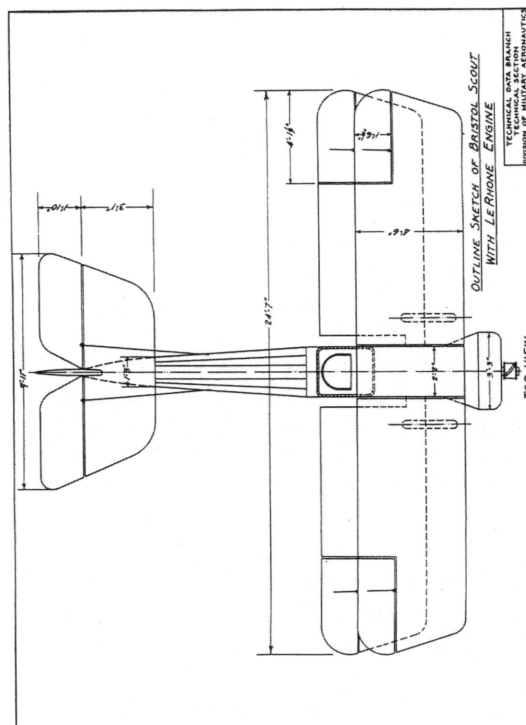
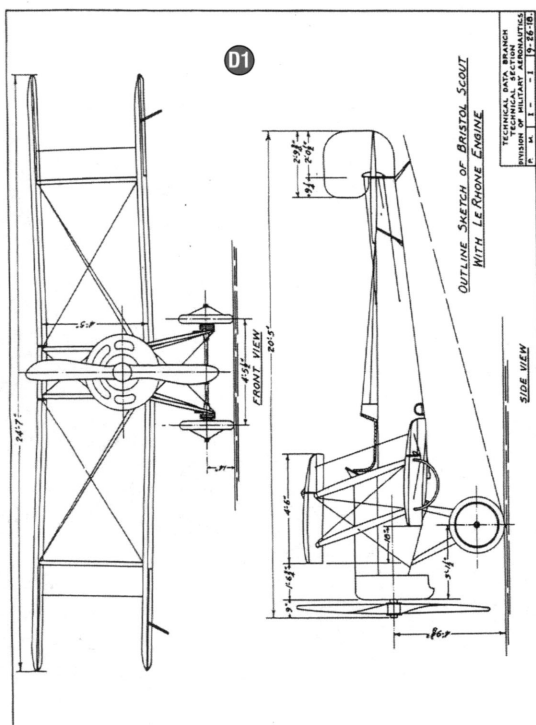
6: The Scout D was the first British operational type to mount a synchronising gear for the Vickers. This shows what may have been the first test application of the Vickers-Challenger gear where the gun firing button was activated by a long oscillating rod controlled by a cam and drive working from the oil pump (Dolf Goldsmith)



7: Scout D RNAS serial N5400 powered by a 80hp Le Rhone photographed at East Fortune (East Lothian) in the summer of 1917. The pilot presumably became tired of being bombarded with empties from the Lewis and has had a collector bag fitted. As the Scout presumably belongs to a Home Defence detachment, one wonders, what appears to be a B.E.12 seen in the background carrying two 112lb bombs, is doing at East Fortune?



8: One Scout D (RNAS serial 8976) was shipped to Australia in 1916. It was renumbered CFS 10 and later CFS 4 on the strength of the Central Flying School at Point Cook. This photo dates from 1919/20 but it was not until 1926 that the Scout was struck off charge and handed over to the Footscray Technical School as an instructional airframe



D.1: One of the hurried schemes drawn up in the USA in the summer of 1917 was one to manufacture the Bristol Scout D with an 80hp LeRhône engine in the USA as a fighter trainer. A somewhat worn Scout (it had been rebuilt twice) was despatched in August 1917. The story of this machine and the reasons why it was not adopted are complex. It was last recorded as being in storage at Wilbur Wright Field at Dayton Ohio in April 1921. This dimensioned GA was drawn up by the Technical Data Branch Technical Section of the Division of Military Aeronautics USAS and dated September 26th 1918. It shows a slotted cowl fitted at McCook Field as part of a refurbishment

Scout D, RFC serial 7053 of the Armament Experimental Station at Orfordness in 1917. The Vickers here appears to have been fitted with the Sopwith-Kauper synchronising gear (usually associated with the RNAS). Note the large chute to dispose of the empty cases from the left side of the breech and the disintegrating Prideaux links emerging from the bottom of the breech (J.M. Bruce/G.S. Leslie)



possibly shotguns or duck guns (as indicated in the Admiralty armament standard in 1914/15), Lewis guns similarly stripped (against regulations initially) and eventually the first Vickers with a synchronising gear. A variety of missiles was carried primarily in the rather optimistic hope that the Scout could climb above a Zeppelin and drop them on to the envelope below. One Scout pilot actually managed this, RNAS Flt Lt C.T. Freeman in 8953 emptied his Ranken Dart containers over LZ.17 to no effect. The missile collection included hand and rifle grenades, incendiary flechettes, probably ordinary solid steel flechettes (steel darts dropped to injure men or horses), Ranken darts (incendiary missiles), RL (Royal Laboratory) tubes through which were dropped flares and small incendiary bombs and a primitive incendiary candle. The RNAS did fit a carrier for four 20lb Hale bombs to some Scouts, located rather precariously under the nose just behind the engine. In fact it seems that the only weapons used in the air in WW1 which were not fitted to the Scout were rockets and 37mm cannon. Eventually of course the standard weapon was a single Lewis, although some pilots had extra ones fitted in various positions. The commonest arrangement was overwing and there were several variations on this. Mounting fixed Lewis guns to fire through the propeller arc without the refinement of deflectors or a synchronisation system was not irregular, in fact the RNAS approved of the arrangement. In his memoirs Group Captain E.L. Gerrard writing about the period up to May 1915 commented... 'We then tried firing through the propeller without any protection. The surprising conclusion was reached that 200 rounds could be fired through an ordinary scout's propeller without much risk of fracture, about one round in 20 actually striking the propeller. The portion of the propeller affected was tightly bound in varnished fabric in order to minimise splintering'.

The Bristol Scout might have been developed into a fighter but it never quite made it. Armed with a Vickers synchronised by a better system such as the Scarff-Dybovsky (which was used on the Sopwith Pup) it might have been successful. After all, the Vickers was a superior armament to the single Lewis which armed the D.H.2 and F.E.8 pusher scouts. A more powerful engine did not always lead to an overall better performance and the Sopwith Pup and the improved Nieuport scouts were becoming available. The Scout remained in service as a training aircraft or as a unit hack but unlike its fellow veteran the Avro 504 large numbers were not available for the limited civil market after the war. Sadly, only one Scout survived on the civil register, a Scout D (ex R FC 5570) which became G-AEGR. It survived until 1930.

References etc.

The Bristol Scout has always been a popular subject for modellers, flying scale and static, but most references will not be available to the average modeller so only the most recent are mentioned here. One point is worth keeping in mind, it might be thought that research into WW1 aviation has been more or less completed, expressed in the phrase once heard... 'what else is there to say about it?' In fact this is quite wrong, research continues and this writer has never ceased to be surprised at the amount of new information that surfaces or is carefully dug out of obscurity by a handful of dedicated amateur historians (for all are amateurs). The consequence is that those who write articles and monographs need to keep up to date by subscribing to all the publications which specialise in early aviation.

In January 1965 a new type of publication appeared, the Profile series. The first covered the S.E.5a and the series went from strength to strength. It was the increasing popularity of the plastic kit which not only opened up the hobby but led to the subsequent vast outpouring of the aviation and model publishing industry. No.139 in the series covered the Bristol Scouts C and D and was published in 1968, a long time ago but many PROFILEs seem to be still available. However, much more recent material can be mentioned. In *Air Enthusiast* No. 32 (published circa Winter 1988) a very fine and detailed study with a cutaway drawing was published. The title was *Bristol's Fighter Manque* (manque meaning a missed opportunity).

Although the reader may consider these references to be old and no longer easily available the writer has been surprised by the number of times that the ancient *Harborough* series is mentioned as a reference. This seminal book series dating from the 1950s/60s set a standard for the day and *Fighters of WW1* was published in 1959 (reprinted in 1960) and it seems that many copies are still around. Of course the most up-to-date reference is the *Windsock Datafile* No.44 published in 1994. Jack Bruce authored all three references noted which is a guarantee of authenticity. The drawings in two scales are the best available and without doubt served as the reference for the Gavia 1/48th scale kit of the Scout recently issued. The writer has yet to see the kit but the box art, always of a high standard on these Central and Eastern European kits, is excellent. Depicting one of the most famous Scouts (Hawker's RFC 1611) it shows a roundel on the undersurface of the lower wing outlined in white. This is doubtful, the thin white outline which became standard for all RFC/RNAS/RAF aircraft later in the war was a feature of many early RNAS machines.

The pictures included with this feature are intended as a guide and especially so far as armament is concerned, a subject not always adequately covered in detail. MAM



Locust Tornados

by Andy Evans

Airbrakes out, probe out, canopy raised, this Locust Tornado awaits its next mission. Note the apparent absence of any markings



The sand scheme is shown to good effect in these two shots





1. After the unit's return to Italy the aircraft retained their sand scheme for some time. Seen prior to a sortie a Locust Tornado taxis past the camera; of note are the two-colour tanks and the very low-vis markings!



2. Captured during an exercise with the Turkish air force, a Locust Tornado prepares to 'go', in the company of a Turkish F-4

3. Seen at the 1991 International Air Tattoo, note demarcation line on the mainwheel door of the sand and silver colours

(© Gary Davison)

4. A tiger's head emblem adorned both sides of the engine air intake on this IAT Locust Tornado

(© Gary Davison)



5. Making an impressive take-off from the IAT runway, this Italian Tornado heads skyward. Note the large number '301' on the tail, denoting its participation in the Paris Air Show a few weeks before. Note the 'buddy buddy' pod on the centreline

(© Gary Davison)

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Flashbacks EA-7L

by Andy Evans

ELECTRONIC WARFARE CORSAIR

A crew member pulls away the air hose as 'Flashback 04' achieves engine start and prepares to 'roll'. Note the red markings that break up the weathered paintwork and add a dash of colour to an otherwise drab aircraft. Also of note is the refuelling probe beneath the cockpit

One of the most important aspects of modern aerial warfare has been the evolution of the so called 'beam weapons', falling under the general heading of Electronic Warfare (EW). The need to train aviators in the art of dealing with such threats is obviously high on any armed force's agenda. Nowhere was this taken more seriously than in the United States, and the development of more sophisticated EW equipment by, amongst others, the then Soviet Union was perceived quite rightly as a challenge to the lives of its aircrew.

Being at the forefront of Global Power Projection the US Navy took the decision to provide training in the necessary EW management skills to its aviators and fleet units. Thus during the early 1970s they formed a specialised Electronic Warfare Aggressor unit, VAQ-33, that would operate from NAS Key West in Florida. Their operations were a huge success, so much so that due to the increasing demand on their time and talents it became clear that a second unit was needed, this time on the West Coast of the US to complement the work of VAQ-33.

As a consequence, on March 1st 1983 the Navy commissioned VAQ-34 the 'Flashbacks', a name that reflected their role as airborne threat transmitters. The unit was equipped with four examples of the Douglas A-3 Skywarrior, the ERA-3B 'Electronic Whale', a single KA-3 Skywarrior Tanker and an unusual and interesting variant of the famous Vought TA-7 'T-Bird' the EA-7L. Operating from NAS Point Mugu six EA-7Ls (of eight so designated) soon became a familiar sight.

The unit received six versions of the EA-7L 'Jammer-SLUF', the 'E' prefix denoting its specialised mission, in a similar vein to the EA-6B Prowler's monitor. These aircraft were the only examples of this variant ever produced. Basically the EA-7L was a redesignated TA-7C two-seat training aircraft modified to carry a variety of externally mounted jammer pods, radar simulators and chaff and flare dispensers. The two-seat application allowed for a second Naval Flight Officer (NFO) to handle all the highly charged and demanding EW 'spoofing' whilst the pilot got on with the job of flying the plane. These

'back seaters' were again an unusual breed, being the only 'EW-Sluffers' in the world!

The EA-7Ls carried such systems such as the ALQ-170 Anti-Ship Missile Simulator. This unit was designed to give the aircraft the appearance of an inbound ASM, and could be utilised against airborne, seaborne or land-based radar sites to test and hone their operators' skills. Other available fits included the AN/ALQ-167 Noise Jammer, and the AN/AST-4 Missile Simulator pod. As the aircraft were 'multi-tasked' a typical mission would see them carrying a mix of these podded systems on their wing pylons.

As with most of these 'specialised units' the ending of the cold war sounded the death knell for their operations. Although an excellent aircraft, the TA-7 airframe was also due for retirement. Thus VAQ-34 bit the dust in the early 1990s, and their aircraft were consigned to AMARC at the Davis-Monthan 'Boneyard', where they still remain.

Modelling the EA-7L could be a worthwhile project. Although no dedicated injection moulded two-seat Corsair exists, Conversion kit have been produced in both 1/72nd and 1/48th scales for the basic TA-7 airframe. As there are no real external airframe differences between the TA-7 and the EA-7 the conversion should be reasonably straightforward. You will however need to use a Navy A-7 Corsair as the basis for the conversion as the Navy style of refuelling probe will be required, rather than the boom receptacle found on the A-7D

EA-7L Serial Numbers

Type	Code	BuNo.	Fate
EA-7L	GD 200	156745	Davis-Monthan 25 Sept 91
EA-7L	GD 201	156741	Davis-Monthan 25 Sept 91
EA-7L	GD 202	156743	Crashed 19 July 1990
EA-7L	GD 203	156786	Unknown
EA-7L	GD 204	156757	Davis-Monthan 22 Aug 91
EA-7L	GD 205	156761	Davis-Monthan 17 Nov 94
EA-7L	GD 206	156791	Davis-Monthan 17 Nov 94
EA-7L	GD 207	156794	Unknown



1. A side view of the EA-7L. Note the side-hinged canopy of the TA-7 ilk, the yellow primer painted access door and the lack of the VAQ-34 legend on the tail

2. VAQ-34 received just six examples of the 'Jammer-SLUF'

3. As there are no real external differences between the TA-7 and the EA-7, so the conversion should be reasonably straightforward

4. Basically the EA-7L was a redesignated TA-7C two-seat training aircraft modified to carry a variety of externally mounted jammer pods, radar simulators and chaff and flare dispensers



Air Force version. The various jammer pods will need to scratchbuild, and references for these can be found on the Internet and in Detail & Scale's A-7 monograph.

When they first entered service the EA-7Ls wore the traditional Navy scheme of Gull Grey and White, but in line with the tactical thinking of the late 1980s they were repainted in the now familiar low-vis grey colour scheme. As with other Corsairs that received this colouring, they soon took on 'weathered' look, with paint patches and wear marks appearing all over the airframe. The early high visibility tail markings featured the letters 'GD' shot through with white lightning flashes. These unit markings were, for a short time carried onto the low-vis grey scheme aircraft, appearing as dark grey flashes with white letters. These subsequently gave way to a single red

star on the tail, together with VAQ-34 lettering on the lower forward portion of the fin. Early examples had a white lightning bolt behind the red star, later versions just had the star. The aircraft also carried a red two-digit code on the either side of the engine intake, and this was repeated on the top of the tailfin. All other national insignia, caution and warning stencils were in dark grey and could be found in the 'usual places' for an A-7. On a personalised note, each aircraft carried the names of its crew just below the canopy rails, usually in red.

The EA-7L is another of the more 'unusual' aircraft that have now disappeared from service and possibly from the aviation consciousness! However, with a little effort perhaps one or two 'Flashbacks' may yet see the light of day in a model collection? [MAM](#)